
NAVAL AVIATION VISION
2020

NAVAL AVIATION VISION

To deliver the right force with the right readiness at the right cost at the right time...

...today, and in the future.


NAE

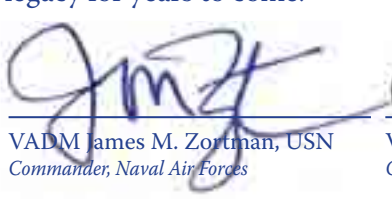
Opening Letter from Naval Aviation Enterprise Leadership

Naval Aviation Vision 2020 is our roadmap to the future, defining the way ahead for Naval Aviation in the 21st century. Our Navy and Marine Corps are undergoing a significant transformation in readiness postures, deployment strategies, and manpower initiatives. We are fully engaged in the Global War on Terror, a conflict that will require American combat power for many years to come. Under real-world combat conditions, we are demonstrating the unequivocal flexibility of large-deck aircraft carriers and amphibious vessels, operating in concert as Carrier and Expeditionary Strike Groups, well-equipped and superbly trained to take the fight to the enemy. We are employing cutting-edge technologies to help us operate, fight, and win more effectively and more efficiently, making the most of our precious resources.

Inside this document you will read about the unique advantages and capabilities of Naval Aviation. You will learn about our heritage and current operating guidance, and understand the importance of maintaining a flexible response, so vital toward mitigating the uncertainties of asymmetric warfare. You will be introduced to the Naval Aviation Enterprise (NAE) and its vision of delivering the *right force* with the *right readiness* at the *right cost* at the *right time*. You will learn how the NAE's warfighting partnership is revolutionizing the way Naval Aviation operates, through process improvement initiatives, eliminating stovepipes, and bringing key stakeholders together to solve issues interdependently, for the greater good of Naval Aviation. In the section on "Future Readiness," you will read about planned improvements for specific platforms, and you will gain a new understanding of Sea Power 21 and how specific aircraft and weapons systems drive this construct toward operational reality. In the section titled "Naval Aviation Science and Technology," you will get a glimpse of future initiatives, designed to improve our ability to fight and win against any adversary, anywhere in the world.

"The Right Force" pertains to our most valuable asset—our people. Naval Aviation is only as strong as the people who launch, recover, repair, fly, and maintain its aircraft and weapons systems. As such, it is imperative that we work hard to attract, develop, retain, and reward the many selfless, service-oriented Americans who step up and answer the call for duty. Naval Aviation's leadership is committed to crafting an overarching Human Capital Strategy so that we have the right force in place to answer the call when our country needs us. "The Right Cost" introduces a fresh philosophy of fiscal stewardship and cost management, one that balances readiness with cost and uses meaningful metrics to tie productivity to expense, so that the NAE can make smart investment decisions. Naval Aviation will endure because we understand the importance of managing our resources today, to prevent mortgaging the capabilities of tomorrow.

Naval Aviation's heritage is one of victory, forged under demanding conditions in treacherous operating environments throughout the world. The Naval Aviation force of tomorrow, equipped with the best technology, aircraft, and systems, will continue that legacy for years to come.



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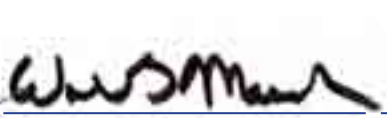

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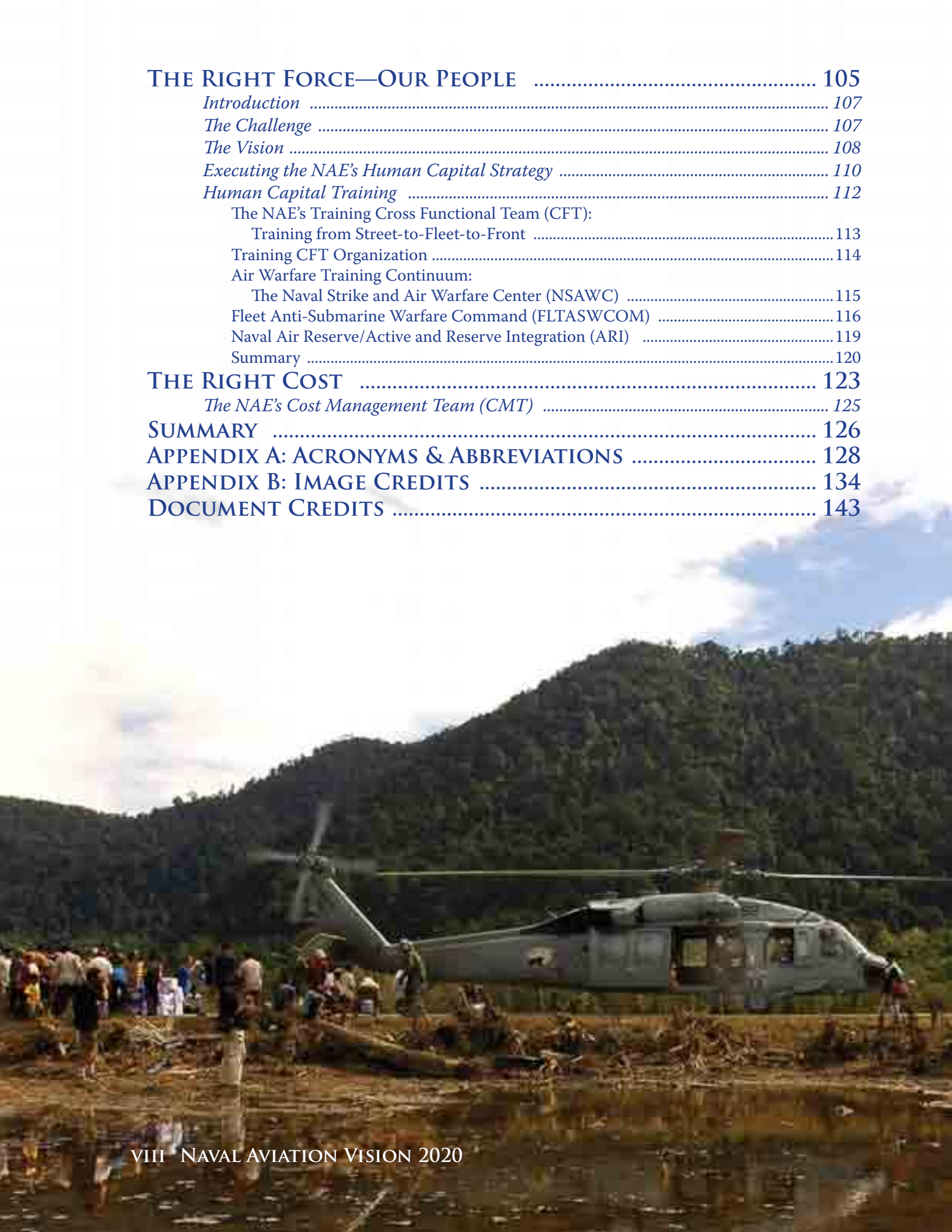
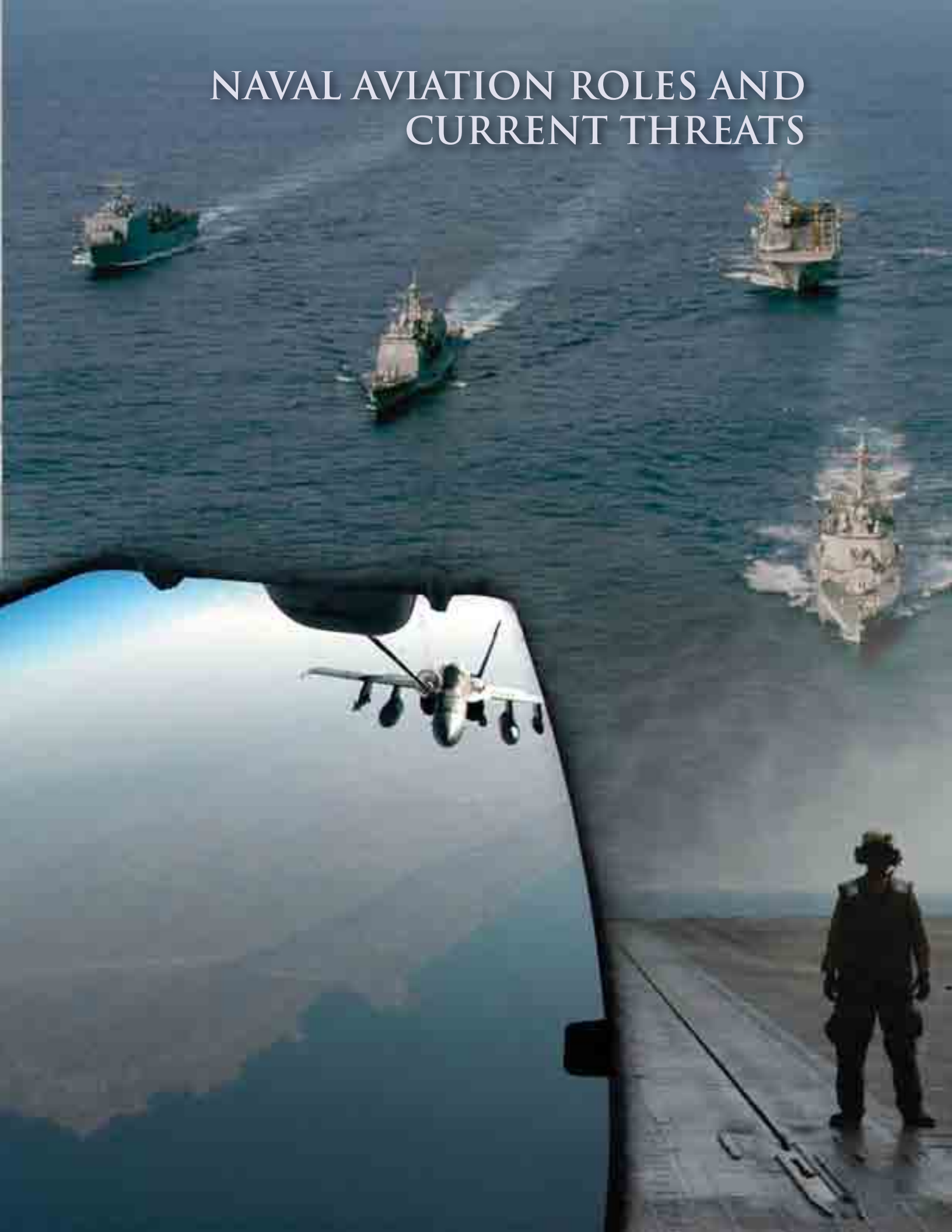


NAVAL AVIATION ROLES AND CURRENT THREATS



Enduring Roles of the Navy

U.S. Navy Carrier Strike Groups (CSGs) are the global standard for sea-based airpower, representing an unmatched capability to strike targets on land and sea. For over 60 years, the aircraft carrier has signified the resolve of the United States to maintain regional stability and peace. Most recently, Operations Enduring Freedom (OEF) and Iraqi Freedom (OIF) demonstrated the fundamental importance of the large-deck carrier to our national security, projecting the will of the United States far from the homeland, without reliance on host nation support.

In the 21st century, the *NIMITZ*-class carrier and its embarked air wing will continue as the centerpiece of Naval Aviation's forward presence and power projection. *CVN 21*, the next class of aircraft carrier, will soon join them bringing state-of-the-art, networked, warfighting systems to dominate the sea-land-air battlespace. When the President of the United States asks, "Where are the carriers?" they will be ready, just as they have always been, to surge forward, turn into the wind, and assume whatever role is required: full-scale Joint/combined operations, presence, strike, surveillance, humanitarian assistance, small-scale contingency operations, and special operations. Their readiness and agility will offer our national leadership flexible, scalable, and sustainable options.

Listed below are the enduring roles of the U.S. Navy and Marine Corps. They demand the formidable presence and striking power of our Carrier and Expeditionary Strike Groups (ESGs), armed with Naval Aviation's best tactical aircraft and weapons systems.

- **Assurance and Deterrence**
  A forward-deployed Navy and Marine Corps, ready to project power, shape events, deter conflict, and defeat aggression, demonstrates our nation's commitment to its allies and friends.
- **Command of the Seas**
  Our Naval Forces guarantee freedom of the seas, and in so doing, preserve the vitality and well-being of our nation and the international community.
- **Power Projection**
  The U.S. Navy and Marine Corps project power to disrupt, deny, and destroy hostile forces. Naval vessels are sovereign U.S. territories that deploy rapidly and flexibly around the globe with no requirement for host nation support, and no restrictions imposed by territorial boundaries.
- **Homeland Defense/Security**
  Naval Forces are the first line of defense for the American homeland, protecting our shores by keeping attacks at bay far across the seas. Deployed forward, our forces detect, deter, and interdict attacks by hostile nations and emerging non-state actors.

Current Threats

U.S. Navy and Marine Corps forces face persistent and emerging strategic challenges in four broad categories.

Asymmetric Threats

Asymmetric warfare is a significant 21st century challenge. The antithesis of traditional, "army-on-army" warfighting, irregular asymmetric warfare is the modus operandi for terrorist organizations and the impetus behind the Global War on Terror (GWOT). Asymmetric attacks on U.S. Naval Forces could involve submarine warfare in littoral waters, or "swarming" by vast numbers of small, fast vessels. Combating this threat will take agility, flexible response, and a transformation of ordinary Naval and Joint doctrine.

Catastrophic Threats

Weapons proliferation continues to cause concern, as does the circulation of Weapons of Mass Destruction (WMD), including Chemical, Biological, and Nuclear (CBN) weapons. Technological advances have made WMDs easier to develop, and non-state actors, such as terrorist organizations, threaten to gain access to CBN weapons as well. Ballistic missiles threaten our deployed forces and the U.S. homeland, dictating the need for sea-based Theater Air and Missile Defense (TAMD).

Disruptive Threats

Globalization is enabled by technological innovation and refers to the interconnectedness of economics, transportation, and communications. The world's dependency on this interconnectedness is a considerable vulnerability, because it creates opportunities for subversive organizations with limited resources to cause significant damage. Crises once viewed as regional quickly become global in scope and implication, affecting critical infrastructures worldwide. Cyber-technology, Directed Energy Weapons (DEWs), and Anti-SATellite (ASAT) weapons are disruptive instruments that warrant legitimate concern.

Traditional Threats

Rogue states that seek to reduce U.S. influence in their regions will continue to present traditional threats. Of particular concern are their large conventional militaries and interest in acquiring nuclear weapons. In addition, rising global powers are modernizing and expanding their naval forces for blue water operations. In some cases, their level of economic and military strength is comparable to that of the United States, presenting difficult diplomatic challenges.

Naval Guidance

The Navy and Marine Corps contribute uniquely to the Joint/Coalition Force, projecting power from the Sea Base. With improved operational availability and distributed operations, Naval Forces create increased uncertainty for potential adversaries.

Sea Power 21 will guide Naval Aviation's support of CSGs, ESGs, Special Operations, maritime interdiction, and Marine Corps deep strike and ballistic missile defense. Stability operations, counterinsurgency, economic interdiction, cyber war, and space operations will all become part of the Navy and Marine Corps' operational focus, requiring extensive Joint-service integration and coalition force strategies. Dissimilar forces will be integrated into unique force packages creating multiple options for theater commanders. Logistics chains will be lean, providing the right resources at the right time. Naval Forces will perform a broad range of missions, from information warfare to military-to-military contacts to humanitarian support, such as the medical and supply assistance provided by the *USS ABRAHAM LINCOLN* (CVN-72) CSG following Southeast Asia's catastrophic tsunami.

The 21st century Navy and Marine Corps will seize the initiative through speed, access, and persistence. They will secure battlefield access and maritime dominance through high operational availability. The flexibility inherent to the Fleet Response Plan (FRP) will combat the uncertainties of asymmetric warfare, and current readiness will be leveraged to provide a measured response, aligned with the intentions of our civilian and military leadership.

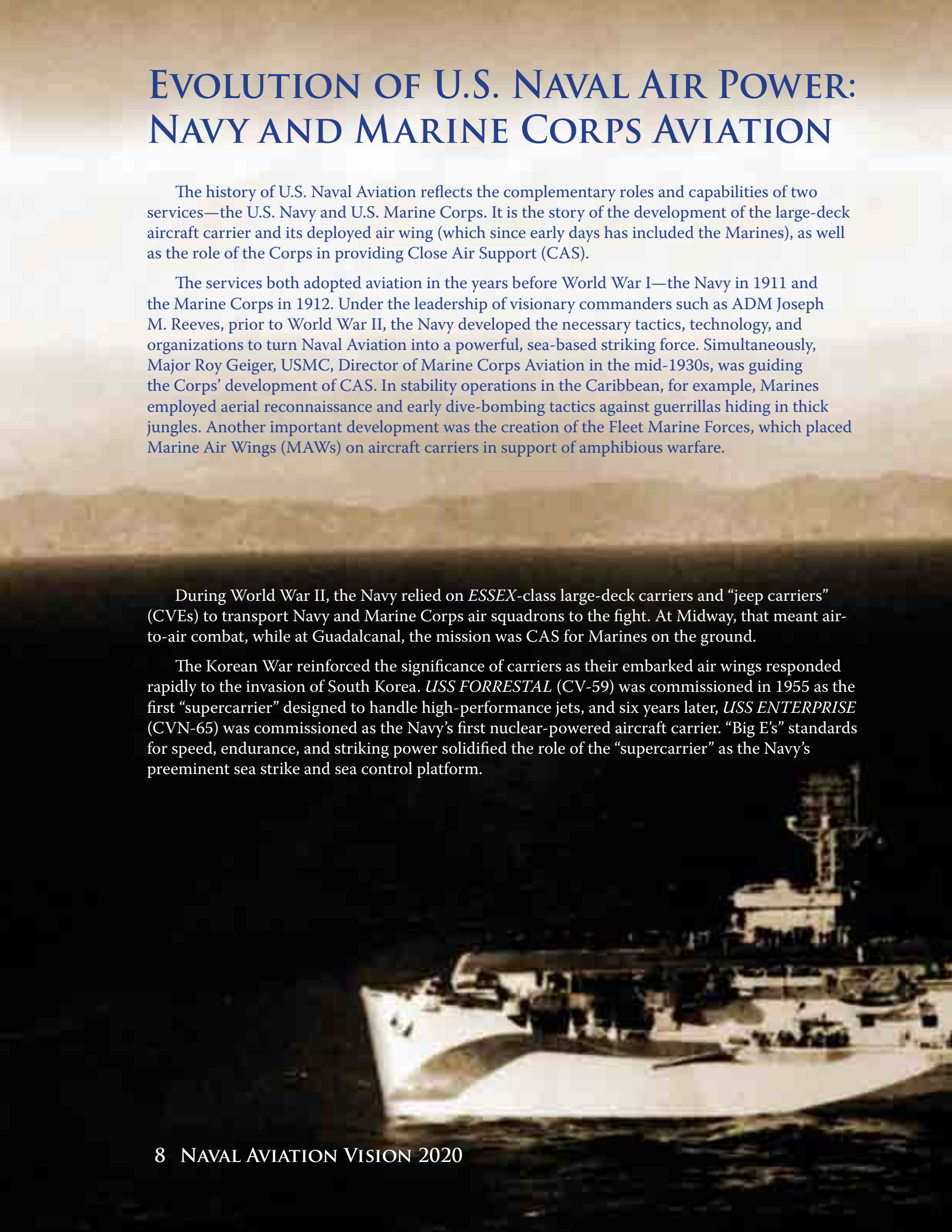
Evolution of U.S. Naval Air Power: Navy and Marine Corps Aviation

The history of U.S. Naval Aviation reflects the complementary roles and capabilities of two services—the U.S. Navy and U.S. Marine Corps. It is the story of the development of the large-deck aircraft carrier and its deployed air wing (which since early days has included the Marines), as well as the role of the Corps in providing Close Air Support (CAS).

The services both adopted aviation in the years before World War I—the Navy in 1911 and the Marine Corps in 1912. Under the leadership of visionary commanders such as ADM Joseph M. Reeves, prior to World War II, the Navy developed the necessary tactics, technology, and organizations to turn Naval Aviation into a powerful, sea-based striking force. Simultaneously, Major Roy Geiger, USMC, Director of Marine Corps Aviation in the mid-1930s, was guiding the Corps' development of CAS. In stability operations in the Caribbean, for example, Marines employed aerial reconnaissance and early dive-bombing tactics against guerrillas hiding in thick jungles. Another important development was the creation of the Fleet Marine Forces, which placed Marine Air Wings (MAWs) on aircraft carriers in support of amphibious warfare.

During World War II, the Navy relied on *ESSEX*-class large-deck carriers and "jeep carriers" (CVEs) to transport Navy and Marine Corps air squadrons to the fight. At Midway, that meant air-to-air combat, while at Guadalcanal, the mission was CAS for Marines on the ground.

The Korean War reinforced the significance of carriers as their embarked air wings responded rapidly to the invasion of South Korea. *USS FORRESTAL* (CV-59) was commissioned in 1955 as the first "supercarrier" designed to handle high-performance jets, and six years later, *USS ENTERPRISE* (CVN-65) was commissioned as the Navy's first nuclear-powered aircraft carrier. "Big E's" standards for speed, endurance, and striking power solidified the role of the "supercarrier" as the Navy's preeminent sea strike and sea control platform.




USNAVY

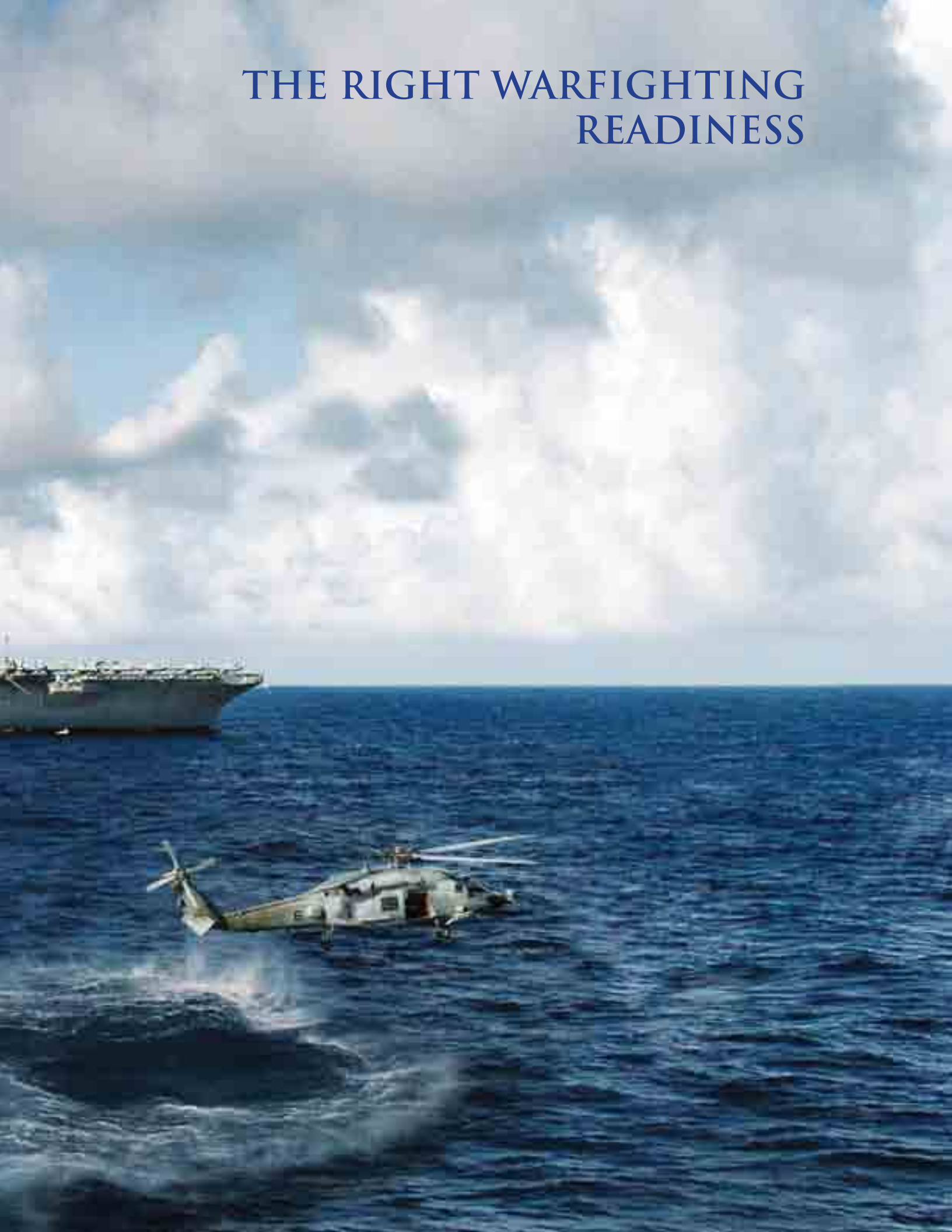
The Cold War era highlighted the rising importance of other aircraft types—particularly helicopters, Short TakeOff/Vertical Landing (STOVL) aircraft, and tilt-rotor aircraft. Deployed from either large-deck carriers or amphibious assault ships, these platforms greatly enhanced the striking power of the Navy/Marine Corps Team. The MV-22 *Osprey* tilt-rotor, assault support aircraft, combines fixed-wing and rotary-wing features to enhance tomorrow's striking power even more.

A higher standard in carrier-based aviation was introduced in 1975 with the commissioning of *USS NIMITZ* (CVN-68), the first in a class of ten, large-deck, nuclear powered aircraft carriers. The tenth and last *NIMITZ*-class aircraft carrier will be *USS GEORGE H.W. BUSH* (CVN-77), expected to join the Fleet in 2009.

Now under development is the *CVN 21*-class, the 21st century aircraft carrier, with an innovative design that dramatically increases the Navy's capability to project "presence with a purpose." The *CVN 21*-class will have better defenses and weapons, increased automation and improved command and control from a new integrated weapons system, a redesigned flight deck, improved propulsion and electrical generation, and better aircraft launch-and-recovery systems. These improvements will reduce costs, enhance effectiveness, and fully integrate the aircraft carrier and its strike group with the Joint Services so that our Sea Warriors can dominate the battlespace.

The speed, agility, and versatility of the aircraft carrier and amphibious assault ships, combined with their Carrier Air Wings (CVWs) and Marine Expeditionary Units (MEUs), have been demonstrated time and again. Often the first to respond, the CSG, ESG, and their warfighting contingents are invaluable instruments of American diplomacy. They are the cornerstones of Naval forward presence, bringing the fight forward with unquestionable force, and upholding the U.S. Navy and Marine Corps heritage of victory at sea.

THE RIGHT WARFIGHTING READINESS



Current Readiness

Operations Enduring Freedom (OEF) and Iraqi Freedom (OIF)

Naval Aviation's current combat readiness is responsible for much of the success in the GWOT. Achieving air superiority over Afghanistan, Navy and Marine Corps aircraft set Operation Enduring Freedom (OEF) in motion, flying over half the total sorties. Seventy percent of those sorties were strike-related, with strike fighters averaging two aim points per aircraft per sortie, a monumental shift from the mass force packages of Operation Desert Storm. Ninety-three percent of Navy and Marine Corps strike sorties delivered precision-guided ordnance in OEF.

For Operation Iraqi Freedom (OIF) in 2003, five carriers plus amphibious ships and shore-based detachments brought an armada of striking power from the sea. Over 700 Navy and Marine Corps aircraft of all types supported OIF. Forty-six percent of the strike aircraft deployed for OIF came from the Navy and Marine Corps, flying over 8,000 sorties and delivering nearly 9,000 precision-guided munitions.

OIF tested the Fleet and the Fleet responded. Seven CSGs deployed worldwide, and those involved in OIF surged to 16-hour flying days for as much as 23 days straight. Seven of ten Carrier Air Wings were deployed, sustaining an 85 percent mission capable rate. During OIF Phase IV Stability Operations, Navy and Marine Corps aircraft contributed to precise strikes in urban operations, and provided supply route security for coalition land forces. Navy and Marine Corps carrier-based aircraft also participated in time-critical strikes, battlespace shaping operations, and CAS for forces engaged in Iraqi cities like Fallujah.

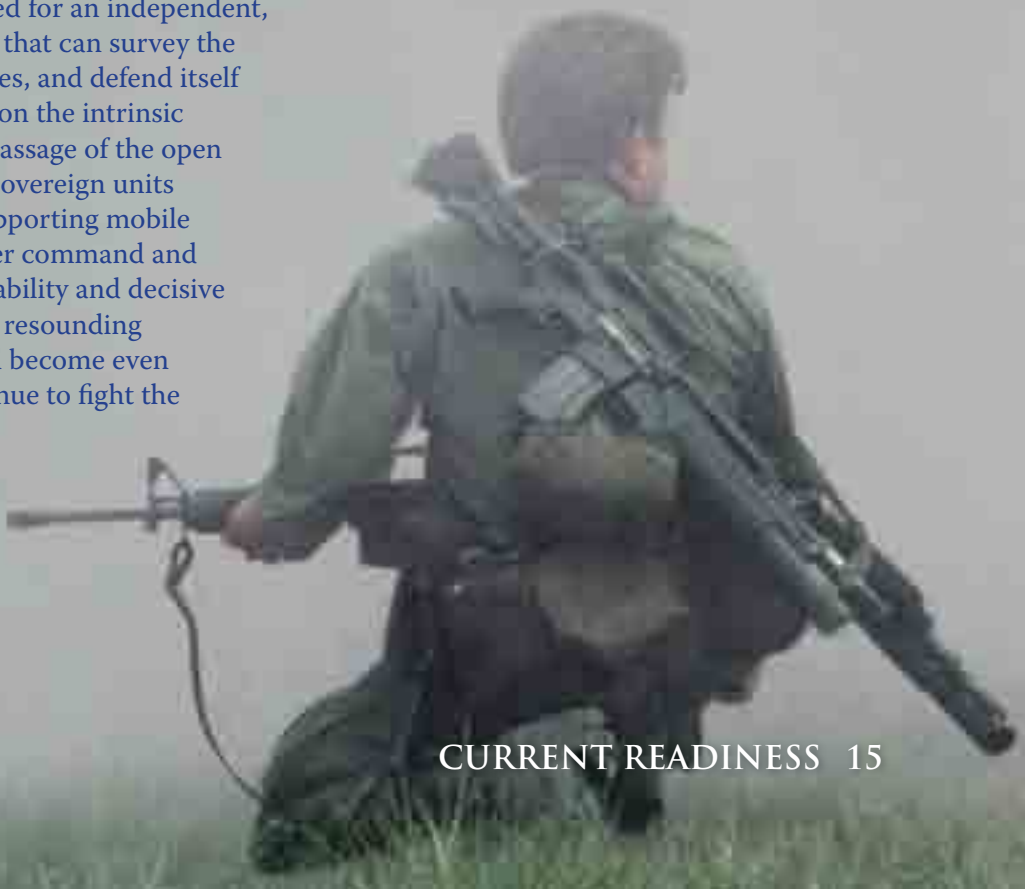
Teams of engineering, test, and evaluation experts throughout the Naval Aviation Enterprise (NAE) supported the development and integration of the weapons used in OIF and OEF, including JDAM, JSOW, HARM, Tomahawk, SLAM-ER, and Laser-Guided Bombs (LGBs). Additionally, aircraft weapon systems integration was provided for ATFLIR, FTI, SHARP, LITENING II Pods, MIDS, DCS, JHMCS, AIM-9X, and AMRAAM systems, as well as Operational Flight Programs (OFPs) for the F-14, AV-8B, F/A-18C/D, F/A-18E/F, and AH-1W, all critical to improving the Warfighter's ability to find and prosecute enemy targets.

State-of-the-art prototype systems were also deployed to forces in-theater during OIF, meeting critical Warfighter requirements. Among them were:

- The Tactical Dissemination Module (TDM), which provides an electronic targeting link between the Combined Air Operations Command (CAOC) and the cockpit. TDM supported over 1,000 OIF missions and remains in theater today.
- The Digital Precision Strike Suite (DPSS), which helps ground units correlate real-time target images with database imagery, and provides targeting quality coordinates to airborne, sea-based, and land-based Warfighters. Hundreds of laptop DPSS systems have been provided to ground and Special Operations Forces (SOF) in the OIF and OEF theaters, and remain in use today.
- The improved, Metal Augmented Charge (MAC) thermobaric warhead for the AGM-114 Hellfire missile, which dramatically increases effectiveness against enclosed targets.

Dedicated 24/7/365 Fleet support of fielded systems was provided through the Warfighter Response Center (WRC). Providing direct, responsive, single-point reach-back to RDT&E expertise, the WRC helped resolve emergent problems with weapon system employment.

The inherent flexibility of the CSG and ESG is perhaps their greatest asset. Ready on arrival in the battlespace, they provide Joint Force Commanders with the unparalleled ability to respond immediately, decisively, and independently—without the requirement for host nation support. At the onset of OIF, host nation support for ground-based aircraft was neither offered nor provided, but aircraft launched from carriers in the eastern Mediterranean Sea were able to strike targets immediately. In the global political environment of the 21st century, it is increasingly unlikely that the United States will have the host nation support needed to conduct military operations, dictating the need for an independent, maneuverable striking force that can survey the battlespace, attack its enemies, and defend itself autonomously. Capitalizing on the intrinsic freedom and international passage of the open seas, the CSG and ESG are sovereign units of U.S. territory, and self-supporting mobile tactical airfields with premier command and control. This significant capability and decisive advantage, realized with the resounding success of OEF and OIF, will become even more important as we continue to fight the GWOT.



Fleet Response Plan (FRP) and Summer Pulse 2004

The FRP is the Navy's operational concept. It supports Sea Power 21 while providing the Navy with a flexible deployment strategy to combat the uncertainties of asymmetric warfare. FRP changes the way we operate, train, man, and maintain the Fleet. The essence of FRP is "targeted readiness"—finding new and cost-effective ways to tailor the mission readiness of our Naval forces, while providing the President with surge-deployable combat power in time of crisis.

The Summer Pulse 2004 exercise, conducted from June through August, was the first demonstration of FRP. As part of the exercise, the Navy deployed seven CSGs—four from the Atlantic and three from the Pacific—in five theaters of operation around the world. Summer Pulse demonstrated Naval flexibility and capability in support of large-scale surge operations, flexed the logistics and shore infrastructure, stressed the operational concepts of Sea Power 21, and improved Navy and Marine Corps interoperability with allies, coalition partners, and the Joint Services.

Summer Pulse 2004 proved that FRP is an operational reality and demonstrated the emergent availability of Naval forces to Joint Combatant Commanders, even while other Naval forces were engaged in OIF combat operations. Summer Pulse lessons learned will be analyzed to improve the functionality and flexibility of the FRP, make our shore supply and logistics infrastructure more agile, refine our training and manpower requirements, and tailor ship and aircraft maintenance schedules. An important outcome will be the ability to assess our resource expenditures, so the right money is spent on the right things and nothing is wasted. That discipline will lead us into the future of Naval Aviation, as we save today's dollars to recapitalize tomorrow's Navy and Marine Corps. Summer Pulse 2004 demonstrated our ability to bring four-and-a-half acres of American sovereignty, on short notice, to any part of the world, reinforcing the value and relevance of Naval Aviation to our national defense strategy.

The Naval Aviation Enterprise (NAE): A Key Readiness Enabler

The processes that drive Naval Aviation readiness and costs span several commands, including Commander, Naval Air Forces (CNAF), Naval Education Training Command (NETC), Naval Air Systems Command (NAVAIR), Naval Sea Systems Command (NAVSEA), Naval Supply Systems Command (NAVSUP), and the Naval Inventory Control Point (NAVICP). The U.S. Marine Corps and Joint Commands, such as the Defense Logistics Agency (DLA), also impact readiness and cost.

The NAE is a warfighting partnership where interdependent issues affecting multiple commands are resolved on an Enterprise-wide basis. The NAE enables communication across all elements of the Enterprise, fosters organizational alignment, encourages inter-agency and inter-service integration, stimulates a culture of productivity, and facilitates change when change is needed to advance and improve. Working together optimizes the use of existing resources, manages the costs associated with generating readiness, and harnesses change as a positive force within our Navy and Marine Corps.

The vision of the NAE is *to deliver the right force, with the right readiness, at the right cost, at the right time—today, and in the future*. This vision drives the NAE toward the construct of single process ownership, vital toward establishing a culture of Cost-Wise Readiness—one with improved materiel management, more balanced logistics support, and higher availability through faster turnaround times. Essential to achieving Cost-Wise Readiness is understanding our total force cost structure, managing cost reductions, and making sound

investments as a cohesive Enterprise. The efficiency and effectiveness of the NAE will be measured by the single Fleet-driven metric of *aircraft ready for tasking at reduced cost*. This metric is the standard against which we will measure our ability to deliver the things we value: Cost-Wise Readiness, tied to the demands of our Fleet operators; improved Time on Wing (buying less, but better equipment that stays on the aircraft longer because it is a superior product); Speed/Reduced Cycle Time (aircraft and components spending less time in maintenance); Reliability (Quality); Total Cost; and implementing process efficiencies.

NAE Core Stakeholders

The NAE is comprised of the following Core Stakeholders:

- Commander, Naval Air Forces (CNAF) (NAE Chief Executive Officer)
- Commander, Naval Air Systems Command (COMNAVAIRSYSCOM) (NAE Chief Operating Officer)
- Deputy Commandant for Aviation, Headquarters Marine Corps (HQMC)
- Commander, Naval Air Force, U.S. Atlantic Fleet (CNAL)
- Chief of Naval Air Training (CNATRA)
- Director, Air Warfare Division (OPNAV N78) (NAE Chief Financial Officer)
- Director, Fleet Readiness Division (OPNAV N43)

In addition to the Core Stakeholders, there is a Board of Directors (BOD) comprised of representatives from approximately 20 organizations involved in all aspects of Naval Aviation readiness.

NAE Strategic Goals

Balance Current and Future Readiness

- Support the Fleet Response Plan safely, with improved organizational alignment and operational effectiveness
- Maintain direct, frequent, and continuous communication with Navy Type Wing and Marine Wing Commanders to produce combat-ready aircraft at reduced cost
- Strengthen development and acquisition to maximize the return on recapitalized funds

Reduce the Cost of Doing Business

- Work across SYSCOM/Joint boundaries to maximize our share of the resources
- Provide more products and more capability per dollar to the Fleet
- Use dollars saved through improved efficiencies to upgrade and modernize our aging force

Enhance Agility

- Improve our responsiveness and adaptability
- Communicate better with the Fleet, streamline decision-making, compress management layers, demand accountability, and tailor product-delivery processes

Improve Alignment

- Align with the strategic direction of higher authority outside the Enterprise
- Align NAE functions and processes to provide aircraft ready for tasking at reduced cost
- Communicate our vision so that all NAE employees have a sense of purpose and clearly understand the meaning of their individual contributions to the NAE

Attain and Maintain Visibility Across the Enterprise

NAE Actions

- Prioritize capabilities, define requirements, and efficiently acquire and prepare relevant and optimally sized Naval Air Forces that satisfy our nation's warfighting needs
- Operate with a common set of linked processes, each having an owner, metrics, and an action plan that drives continuous improvement
- Manage with performance and financial metrics as the common Enterprise language
- Install processes that are repeatable, agile, and predictive
- Execute a Continuous Improvement Program designed to define, measure, improve, and control NAE processes, to include Human Capital, acquisition, training, and materiel readiness
- Develop quantifiable outcome metrics to measure our success and cultivate improvements that positively impact current and future Naval Aviation readiness

NAE Initiatives

Using the following initiatives, the NAE will harvest efficiencies in the way it does business, guaranteeing the future of Naval Aviation.

AIR*Speed*

There are three AIR*Speed* Programs that fall under the umbrella of the NAE: Depot AIR*Speed*, which started in 1999; Enterprise AIR*Speed*, which started in 2003; and NAVAIR AIR*Speed*, which started in 2004. All of these initiatives use industry-proven, best business process methodologies (or tools) to increase efficiency and productivity, so that products are delivered to the Fleet faster, at reduced cost. The tools are: Lean, Theory of Constraints (TOC), and Six Sigma.

Lean principles strip out waste from every aspect of production, such as the flow of materials from suppliers and the flow of goods to customers. Lean reduces Work-In-Progress (WIP), speeds processes, and is used to identify and eliminate non-value added steps that cause delays, driving costs up.

TOC is a tool that identifies and corrects bottlenecks and constraints, addresses interdependencies, and creates a culture wherein customer demand drives workflow (known as a "pull system").

Six Sigma examines variation that causes rework, driving costs up. Using statistical analysis as the basis for standardization, Six Sigma targets the issues that have the greatest impact on customer value.

Depot AIR*Speed*

Depot AIR*Speed* is now deployed across all three NAE Depots: Cherry Point, Jacksonville, and North Island. The mission of Depot AIR*Speed* is to reduce cycle-time, improve productivity, and establish a culture of continuous process improvement. Specific Depot AIR*Speed* goals are:

- Reduce WIP inventory
- Reduce operating expenses
- Increase throughput
- Improve scheduling accuracy and on-time delivery
- Reduce the number of assets in the depot pipeline
- Establish a "demand-pull" market driven by Warfighter requirements

All three Depots are identifying component flow Critical Paths so that bottlenecks can be eliminated. To date, Depot AIR*Speed* has resulted in:

- The accelerated production of a full squadron of CH-46s (12 aircraft) at the Cherry Point Depot. Turnaround time dropped from 215 to 170 days and WIP dropped from 28 aircraft to 18, using the same staffing level.
- The accelerated production of one-and-a-half squadrons of EA-6Bs (6 aircraft) at the Jacksonville Depot. Re-wing turnaround time dropped from 594 days to 450 and WIP dropped from 16 aircraft to 9, with 5 of the last 7 delivered ahead of schedule.
- The accelerated production of more than one squadron of F/A-18s (12 aircraft) at the North Island Depot. Turnaround time dropped from 192 to 132 days and WIP dropped from 31 aircraft to 16, while maintaining the production labor-rate at under $78/hour.

The NAE's goal is to deploy Depot AIR*Speed* across all product lines by the end of FY 2006.

Enterprise AIR*Speed*

Enterprise AIR*Speed* aligns Organizational, Intermediate, and Depot-Level supply replenishment and repair processes to the demands of the Fleet operator, enabling the effective and efficient preparation of the right number of cost-wise, Ready-for-Tasking (RFT) aircraft required to perform the mission. When the RFT entitlements are correct, inventory and costs are properly managed and the interdependencies of the Enterprise as a whole, from Organization-Level through Intermediate-Level to supply and acquisition, can then be addressed. Gradually, through Enterprise AIR*Speed*, each entity of the NAE will understand the global impact of its local decisions. The integration of Enterprise AIR*Speed* and Depot AIR*Speed* began in July 2004.

Enterprise AIR*Speed* is an enabler of Cost-Wise Readiness that operates within the NAE's Naval Aviation Readiness Integrated Improvement Program (NAVRIIP), discussed on the following page.

NAVAIR AIR*Speed*

NAVAIR AIR*Speed* extends the success already realized by Depot and Enterprise AIR*Speed* to transactional and non-production service environments. It is the solution to a fundamental need to change the way NAVAIR does business at every level: Headquarters, Competency, Program Executive Office (PEO), Program Manager Air (PMA), Integrated Product Team (IPT), and Business Unit. NAVAIR AIR*Speed* is a cultural transformation that will enable our people to become more productive and more efficient at meeting mission requirements, increase the level of customer satisfaction, and facilitate the availability of resources necessary to fund the future readiness of Naval Aviation. Selected NAVAIR personnel are being taught how to use and implement the AIR*Speed* tools mentioned above by world-class industry experts. Known as Black Belts, this cadre of NAVAIR leaders and experts will shepherd the evolution and development of NAVAIR's process improvement initiatives for years to come.

Naval Aviation Readiness Integrated Improvement Program (NAVRIIP)

NAVRIIP helps understand and control cost drivers. It is focused on achieving *aircraft ready for tasking at reduced cost*, which is accomplished by creating a culture of Cost-Wise Readiness and continuous process improvement. Cost-Wise Readiness is a concept that, when operationalized, will help us achieve the *right* readiness at the *right* cost, as opposed to readiness at *any* cost.

In support of the FRP, NAVRIIP fundamentally changes how the Navy provides manpower, equipment, maintenance, supply, and training to Naval Aviation commands between deployments. The goal of NAVRIIP, which is an NAE Cross Functional Team (CFT) headed by CNAL, is to balance and align interactions between Organizational-Level, Intermediate-Level, and Depot-Level maintenance activities and the associated logistics infrastructure. NAVRIIP measures *inventory, reliability, cycle time,* and *cost* during the Inter-Deployment Readiness Cycle to identify and resolve barriers to improvement. Type/Model/Series (T/M/S) Teams manage readiness and costs at the Carrier Air Wing (CVW) and squadron level, Barrier Removal Teams tackle barriers at every level of the organization, and the Metrics Team develops the metrics by which NAVRIIP monitors progress.

Intermediate and Depot Level Integration/Fleet Readiness Centers (FRCs)

Presently, there are three levels of maintenance in Naval Aviation: 1) Organizational-Level Maintenance, required to operate Naval Aircraft at the squadron level; 2) Intermediate-Level Maintenance, performed by shipboard or shore-based organizations that repair components, engines, and support equipment for their assigned squadrons; and 3) Depot-Level Maintenance, an industrial capability that includes in-depth overhauls and major repairs to aircraft, engines, components, and support equipment.

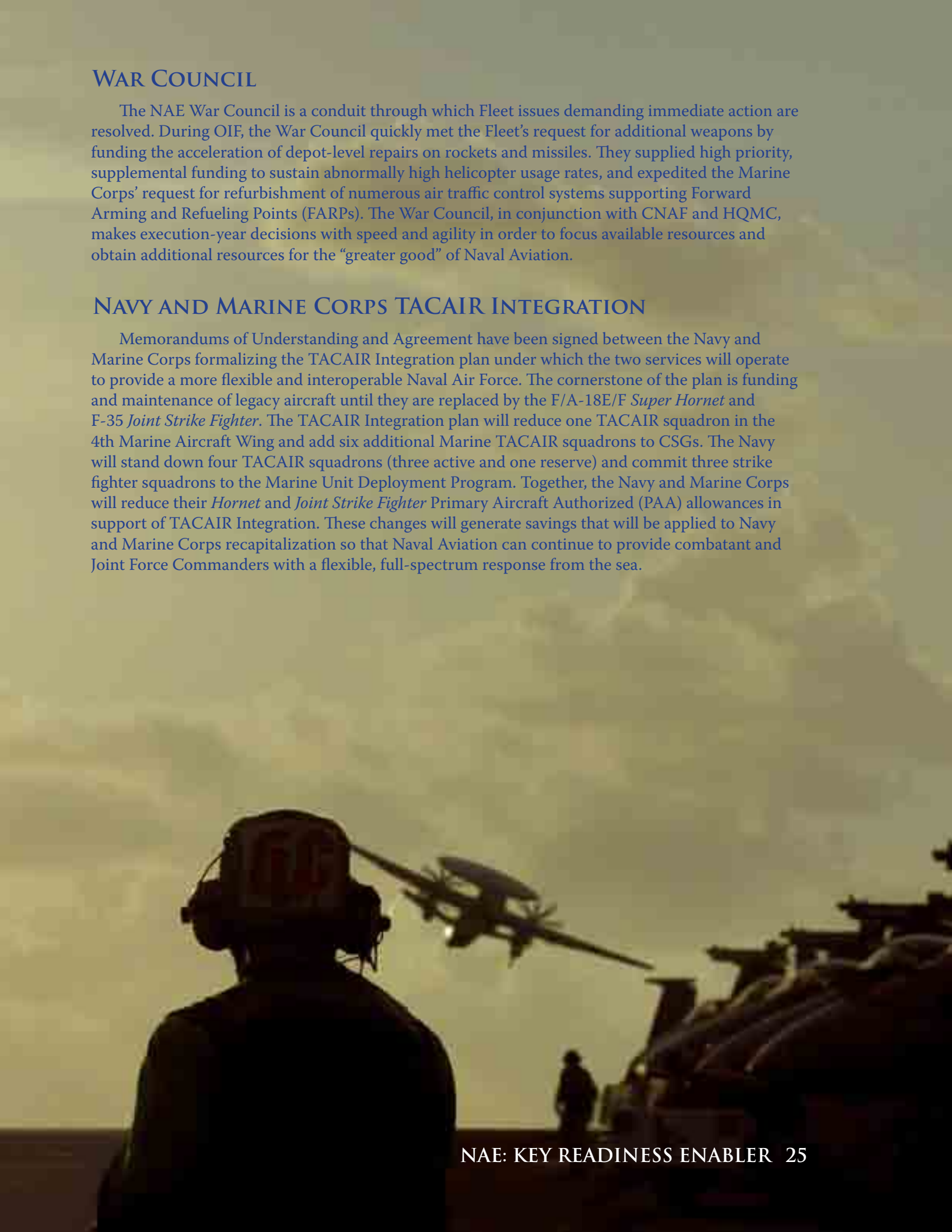
The vision of Naval Aviation maintenance in the future involves just two levels: On-Flight Line and Off-Flight Line. Operational squadrons will perform the maintenance and servicing necessary to actually fly the aircraft (On-Flight Line), much as they do now. When a major component, such as an aircraft engine, is removed, that component will be transferred to an Off-Flight Line Fleet Readiness Center (FRC) located near the home Naval Air Station. The FRC will combine the old I-Level and D-Level capabilities into one facility, and perform the repairs and overhauls necessary to return major components to Ready-for-Issue (RFI) status. The FRC concept will streamline processes and remove barriers between the Navy's retail (I-Level) and wholesale (D-Level) inventories, adding speed to the navy supply system.

War Council

The NAE War Council is a conduit through which Fleet issues demanding immediate action are resolved. During OIF, the War Council quickly met the Fleet's request for additional weapons by funding the acceleration of depot-level repairs on rockets and missiles. They supplied high priority, supplemental funding to sustain abnormally high helicopter usage rates, and expedited the Marine Corps' request for refurbishment of numerous air traffic control systems supporting Forward Arming and Refueling Points (FARPs). The War Council, in conjunction with CNAF and HQMC, makes execution-year decisions with speed and agility in order to focus available resources and obtain additional resources for the "greater good" of Naval Aviation.

Navy and Marine Corps TACAIR Integration

Memorandums of Understanding and Agreement have been signed between the Navy and Marine Corps formalizing the TACAIR Integration plan under which the two services will operate to provide a more flexible and interoperable Naval Air Force. The cornerstone of the plan is funding and maintenance of legacy aircraft until they are replaced by the F/A-18E/F *Super Hornet* and F-35 *Joint Strike Fighter*. The TACAIR Integration plan will reduce one TACAIR squadron in the 4th Marine Aircraft Wing and add six additional Marine TACAIR squadrons to CSGs. The Navy will stand down four TACAIR squadrons (three active and one reserve) and commit three strike fighter squadrons to the Marine Unit Deployment Program. Together, the Navy and Marine Corps will reduce their *Hornet* and *Joint Strike Fighter* Primary Aircraft Authorized (PAA) allowances in support of TACAIR Integration. These changes will generate savings that will be applied to Navy and Marine Corps recapitalization so that Naval Aviation can continue to provide combatant and Joint Force Commanders with a flexible, full-spectrum response from the sea.




CVW-3

Aircraft Inventory Optimization

The NAE has begun conducting aircraft inventory reviews of all aircraft T/M/S to develop the optimum balance between requirements and usage. Leading this initiative are the Type Wing Commanders, Program Managers, and Requirements Officers. Their assignment is to optimize Naval Aviation's inventory by conducting zero-based reviews of all aircraft, assessing accident rates, anticipating combat attrition, devising spares policies to improve operational availability, and determining inventory for all current and planned aviation acquisitions. The overriding objective is to retain and procure only those aircraft necessary to meet mission requirements with acceptable risk, resulting in a leaner, less expensive, and more productive Naval aircraft inventory. Although each aircraft community will be reviewed individually, the impacts of the solutions developed are considered across the entire NAE.

For example, the number of aircraft configurations in the EA-6B community was reduced from four to two, and the number of aircraft overall was reduced from 120 to 108. This decreased the number of required outer-wing panel replacements, freeing up $20.4M in FY 2004. Some of this money was returned to the Navy and some was invested in fixing historically troublesome aircraft components. The Fleet Replacement Squadron's student throughput became faster and more productive because the focus of the Maintenance Department had been changed to support a leaner inventory.

Inventory Optimization leads to fewer aircraft configurations, more reliability, and higher aircraft utilization rates. Fewer aircraft configurations allow Depots to reap the maximum benefit from initiatives like Lean, TOC, and Six Sigma, such that aircraft "down time" is decreased and the Depot-level repair process becomes faster and more efficient.

Future Readiness

Sea Power 21

In the 21st century, innovative concepts and technologies will integrate sea, land, air, space, and cyberspace to a greater extent than ever before. In this unified battlespace, the sea will provide a vast maneuver area from which to project direct and decisive power around the globe.

Future Naval operations will use revolutionary information superiority and dispersed, networked force capabilities to deliver unprecedented offensive power, defensive assurance, and operational independence to Joint Force Commanders. Our Navy and Marine Corps will dominate the continuum of warfare from the maritime domain—deterring in peacetime, and winning in wartime. To realize the opportunities and navigate the challenges ahead, we must have a clear vision of how our Navy and Marine Corps will organize, integrate, and transform.

Sea Power 21 is that vision. It will align our efforts, accelerate our progress, and give us the pervasive knowledge, speed, agility, and persistent precision necessary to defeat our enemies. It will guide our Navy and Marine Corps as we defend our nation in the uncertain century before us. Sea Power 21 encompasses four major concepts, or pillars: FORCEnet, Sea Strike, Sea Shield, and Sea Basing.

FORCEnet

FORCEnet ties the pillars of Sea Strike, Sea Shield, and Sea Basing together. It is the persistent integration of warriors, sensors, networks, platforms, and weapons into a networked, distributed combat force across the spectrum of conflict from seabed to space and sea to land. FORCEnet implements the Global Information Grid (GIG) and is the Navy's portal to GIG Enterprise Services (GIG-ES)—a suite of value-added information, web, and computing capabilities that improve user access to mission critical data, enhancing the pervasive awareness of the battlespace. It will transform the way we receive information, enabling decision-makers to react quickly and decisively with superb situational awareness. FORCEnet will harness information required for knowledge-based combat operations and increased survivability, and will also provide real-time enhanced collaborative planning among Joint and coalition partners. FORCEnet will speed the distribution of smart-weapon sensor information, which will improve Battle Damage Assessment (BDA) and facilitate re-strike decisions. It will vastly improve our capabilities in Electronic Warfare (EW), littoral Anti-Submarine Warfare (ASW) and Information Operations (IO), and will enable Naval Aviation combat forces to achieve battlespace dominance in concert with other Naval and Joint forces across the full range of military operations.

Sea Strike

Sea Strike is the projection of precise, persistent, and responsive offensive power. It is how the 21st century Navy and Marine Corps will exert direct, decisive, and sustained influence in Joint campaigns. The CSG and its embarked Carrier Air Wing, and the ESG and its Marine Expeditionary Unit's Aviation Combat Element (ACE), are ideally suited for this type of effects-based warfare, generating the right effect on the right target at the right time. With real-time battlespace awareness, the CSG and ESG can deliver high-volume, lethal fires against critical vulnerabilities, defeating the enemy's strategy early in the conflict. Sea Strike will involve the dynamic application of persistent Intelligence, Surveillance, and Reconnaissance (ISR), Time Sensitive Strike (TSS), Ship-To-Objective Maneuver (STOM), IO, and covert strike to deliver devastating power and accuracy. Sea Strike capitalizes on early war-termination opportunities that would be lost under attrition-oriented warfare, and the strategic flexibility and operational independence of our CSGs and ESGs enables us to take the fight to the enemy—on our terms.

Sea Shield

Sea Shield projects defensive assurance from the sea to dissuade and deter adversaries in multiple theaters. It takes us beyond unit and task force defense to provide the nation with sea-based theater and strategic defense. Sea Shield will protect our national interests with layered global defensive power stemming from control of the seas, forward presence, and networked intelligence. It will enhance homeland defense, assure access to contested littorals, and project defensive power deep inland. As with Sea Strike, the foundation of Sea Shield integrated operations will be information superiority, total force networking, and an agile and flexible sea-based force. Sea Shield forces will defeat attempts at anti-access and area-denial by enemy aircraft, missiles, small surface combatants, mines, and submarines. Highly capable, survivable, sea-based Naval aircraft will extend and dominate the battlespace, augmented by unmanned platforms and Maritime Patrol Aircraft (MPA). Naval forces will defend the Sea Lines of Communication (SLOC) and establish presence ashore, clearing the way for sealift and airlift assets.

Sea Basing

Sea Basing enhances the deployment and employment of Naval expeditionary forces. The maritime battlespace is a secure and autonomous arena for Joint and allied operations, and Naval forces operating on the high seas enjoy a unique level of independence. Sea Basing refers to our ability to project Joint operational independence and sustain forward-deployed Naval forces at sea for extended periods, without depending on host nation support at overseas land bases. As such, Sea Basing serves as the foundation from which offensive and defensive fires are projected—making Sea Strike and Sea Shield realities. Sea Basing will provide Joint Force Commanders with global command and control, and extend integrated logistics support to other services. Afloat positioning of these capabilities will strengthen force protection and free airlift/sealift to support missions ashore. Netted and dispersed sea bases will consist of numerous platforms, including nuclear-powered aircraft carriers, multi-mission destroyers, submarines with Special Forces, and Maritime Pre-Positioning Force (MPF) ships, providing greatly expanded power to Joint operations. Sea-based platforms will also enhance coalition-building efforts, sharing their information and combat effectiveness with other nations in times of crisis.

Sea Power 21 is a concept for which Naval Aviation is well suited. As the muscle of the CSG, Naval Aviation facilitates access in both defensive and offensive environments. The carrier and its embarked air wing provide Anti-Air, Anti-Submarine, Anti-Surface, and long-range strike capability, while simultaneously coordinating battle management as the primary Command, Control, Communications, Computers, and Intelligence (C^4I) asset. The CSG and its Naval Aviation contingent will facilitate the integration of U.S. Naval power into global Joint operations.

Helping create the synergy required to fuse the pillars of Sea Power 21 into a cooperative strategy are two important initiatives: the Virtual SYSCOM (VS) and the Naval Capability Development Process (NCDP).

Virtual SYSCOM (VS) and the Naval Capability Development Process (NCDP)

Fundamental to the Sea Power 21 strategy is cohesive teamwork and cooperation. To that end, the concept of a Navy VS was adopted with the goal of bringing the four Systems Commands together to implement cost-wise, integrated, business and technical practices. The VS provides the consistent and broad base of cost, technical, and programmatic support necessary to shape and enforce the investment strategies of the Navy and Marine Corps.

Sea Power 21 also requires a *forward-looking* investment strategy whereby the right systems are developed and procured. The VS works hand-in-hand with the NCDP, supporting FORCEnet, Sea Basing, Sea Strike, and Sea Shield with capability-based investment decisions designed to meet future warfighting requirements. The three core NCDP product areas are:

- Sea Power 21 Capability Assessments
- Warfighting Analytic Studies
- Program Wholeness Reviews

A good example of collective SYSCOM efforts is the LHA Replacement, or LHA(R), the next step in the development of large-deck amphibious vessels. LHA(R) is being designed to accommodate the Marine Corps' future ACE including the F-35B *Joint Strike Fighter* and the MV-22 *Osprey*. The VS enhances the dialogue and integrates the tasking between NAVAIR, NAVSEA, and the Marine Corps so that vessels like LHA(R) can perform STOM and Operational Maneuver From The Sea (OMFTS).

Transformation Roadmaps

An integral part of Naval Aviation's recapitalization and modernization plan is the replacement of legacy platforms and systems with new technologies. The following roadmaps describe those technologies and their role in making Sea Power 21 an operational reality. They are the result of thorough, requirements-based research conducted with strategic planners in OPNAV's Air Warfare Division (N78), technical experts from NAVAIR, and combat-experienced aviators.

Aircraft Carrier Roadmap

The aircraft carrier is the cornerstone of Naval Aviation. In the last ten years alone, large-deck carriers have been called upon to respond to, and engage in, over 20 separate international crises, ranging from deterring Iraqi aggression (Operations Northern and Southern Watch) to thwarting attacks on civilians in the former Republic of Yugoslavia (Operation Deliberate Force). In OEF, carrier-based air wings flew strike and combat support missions against Taliban and Al-Qaeda terrorist forces in Afghanistan. In OIF, the carriers operated around-the-clock, immune to hazards such as sandstorms that grounded land-based aircraft. Organic air wings provided strike, electronic attack, airborne early warning, ISR, and other combat capabilities, clearly demonstrating the role of the large-deck aircraft carrier as a permanent fixture in our national defense strategy.

The Navy's fleet of aircraft carriers provides the right balance of forward presence and surge capability needed to wage war in the 21st century. The aircraft carrier projects power across the world's oceans, bringing a versatile, independent striking force to bear against targets that are often hundreds of miles inland. During OEF, carriers in the Arabian Sea launched strikes against terrorist strongholds located deep inside the country of Afghanistan. During OIF, the *USS THEODORE ROOSEVELT* (CVN-71) and *USS HARRY S. TRUMAN* (CVN-75) launched strikes from the eastern Mediterranean Sea against Iraqi targets several hundred miles away. The mobility and self-sustaining operational independence of the carrier provide a unique level of access and on-station persistence that is not dependent on host nation permission or support. Aircraft carriers can remain on-station for months at a time, replenishing ordnance, spares, food, consumables, and aircraft fuel while conducting air strikes and other missions. This capability demonstrates the remarkable operational flexibility and logistical self-reliance of the aircraft carrier, vital to conducting time-critical, "first day of the war" strike operations. The carrier and its strike group are always within reach of being where they need to be, they are ready on arrival, and they bring unequivocal power, presence, and persistence to the fight—independent of land-based supply and support

The current carrier force is largely built around the nuclear-powered *NIMITZ*-class aircraft carrier, of which there are nine presently in service. The last of the *NIMITZ*-class design, *USS GEORGE H.W. BUSH* (CVN-77), is scheduled to enter the Fleet in 2009.

TODAY

NIMITZ-CLASS

Although CVN-77 will have many upgrades and improvements, Service Life Allowances such as weight and center of gravity, electric load margin, aircraft capacity, material handling, and future weapons requirements constrain further growth of the *NIMITZ*-class design. Consequently, a new design is needed to secure the aircraft carrier's role as the centerpiece of the 21st century CSG.

Construction of CVN-78, the lead ship of the *CVN 21*-class, is slated to begin in 2008. The *CVN 21*-class will be the first major design upgrade since 1961, when the nuclear-powered aircraft carrier, *USS ENTERPRISE* (CVN-65), was commissioned. The *CVN 21*-class will boast an improved reactor design and all of the auxiliary systems outside the main propulsion plant will be electrical, eliminating steam/hydraulic and pneumatic piping and reducing lifecycle costs. The improved reactor and zonal electric distribution system will increase electric power generation capacity by 300 percent, enabling new technologies like the Electro-Magnetic Aircraft Launch System (EMALS), and powering advanced command and control systems. The new design will also include an advanced arresting gear system, a redesigned hull, and a more efficient flight deck, reducing manpower requirements by 30 percent. The flight deck will be more flexible with regard to aircraft turnaround and launch and recovery cycles, increasing the numbers of sorties flown per day. The *CVN 21*-class will restore growth and electrical margins no longer available in the 40-year-old *NIMITZ* design, complementing Naval Aviation's transformation. When compared to *NIMITZ*-class carriers, the total operating cost savings are estimated to be over $7.1B per ship.

To meet the demands of 21st century warfare, the *CVN 21*-class will deploy long-range manned and unmanned strike aircraft. Advanced weapons and long-dwell sensors, combined with high-speed sealift, tilt-rotor aircraft, and advanced amphibious assault vehicles, will generate more flexible combat power. Joint Concepts of Operation, centered on the *CVN 21*-class, will leverage the military strengths of our Joint Services, bringing cooperative muscle to the fight and a potent synergy across the warfare continuum.

The design approach and spiral development of the *CVN 21*-class will reduce risk by introducing new technologies and capability at an affordable pace. Armed with aircraft such as the F/A-18 E/F *Super Hornet*, F-35C *Joint Strike Fighter*, and Unmanned Combat Air Vehicles, the *CVN 21*-class aircraft carrier will project dominant maritime combat power well into the foreseeable future.

2020

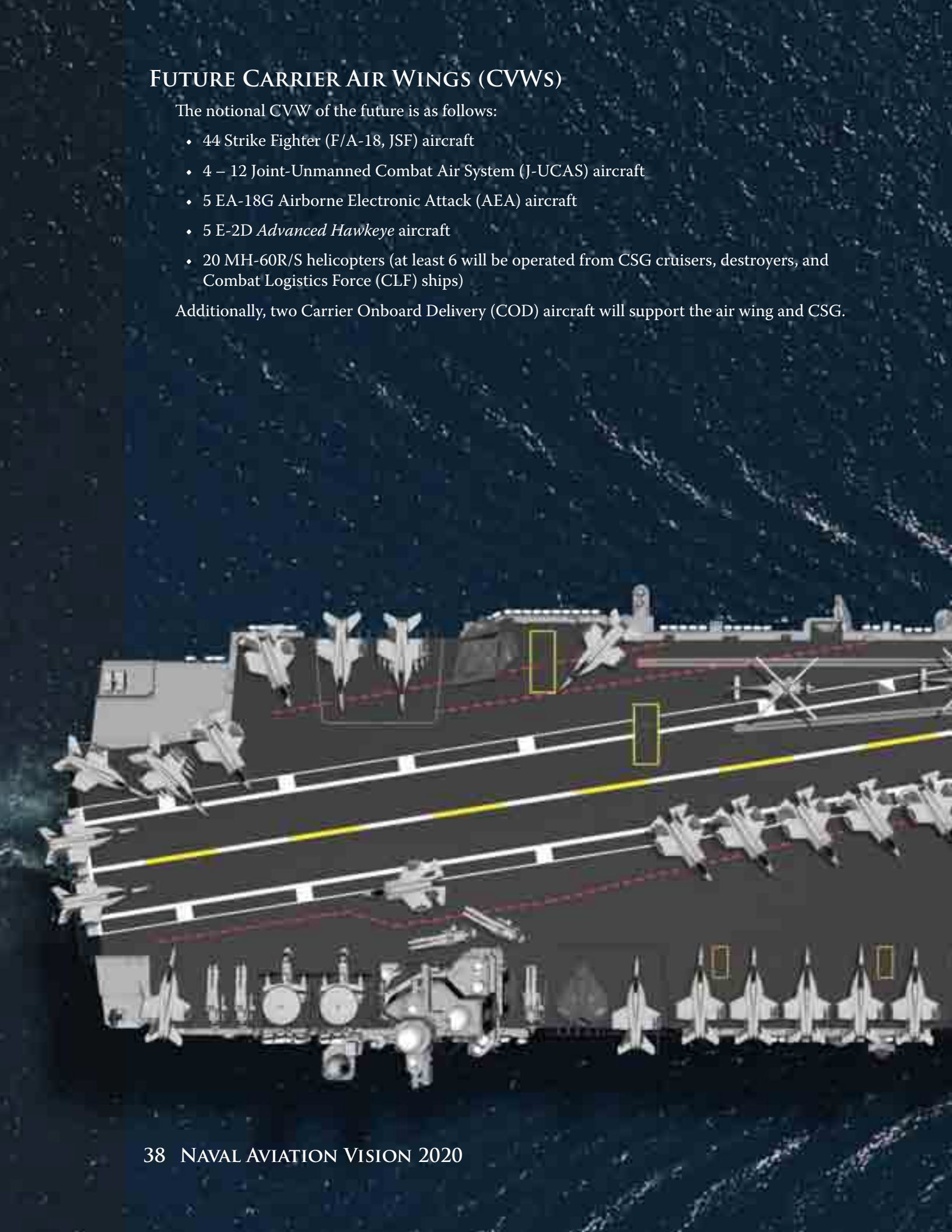
CVN 21-CLASS

Future Carrier Air Wings (CVWs)

The notional CVW of the future is as follows:

- 44 Strike Fighter (F/A-18, JSF) aircraft
- 4 – 12 Joint-Unmanned Combat Air System (J-UCAS) aircraft
- 5 EA-18G Airborne Electronic Attack (AEA) aircraft
- 5 E-2D *Advanced Hawkeye* aircraft
- 20 MH-60R/S helicopters (at least 6 will be operated from CSG cruisers, destroyers, and Combat Logistics Force (CLF) ships)

Additionally, two Carrier Onboard Delivery (COD) aircraft will support the air wing and CSG.




78

F-35B/C *Joint Strike Fighter*

The *Joint Strike Fighter* (JSF) Program will develop and field a tri-service family of next-generation strike fighter aircraft, emphasizing affordability and survivability.

Marine Corps AV-8B and F/A-18A/C/D aircraft will be replaced with the F-35B Short TakeOff/Vertical Landing (STOVL) variant of the *Joint Strike Fighter*. STOVL JSF combines *Hornet* multi-role functionality with *Harrier* basing flexibility, providing the Marine Corps with a low-signature, state-of-the-art aircraft armed with "leap-ahead technology." Initial Operational Capability (IOC) for the F-35B is FY 2012.

The Navy's F-35C will complement the *Super Hornet* thanks to the JSF's all-aspect stealth strike design and 700 nautical mile radius of action (unrefueled). The JSF will enhance the flexibility, power projection, and strike capability of the CVW and the Joint Task Force (JTF). IOC for the F-35C is FY 2013.

F/A-18E/F *Super Hornet* Strike Fighter

There are a number of enhancements to the F/A-18E/F *Super Hornet* that will sustain its lethality well into the 21st century. Upgrades include critical growth capability, enhanced survivability, and weapon bring-back improvement. Avionics upgrades include the APG-79 Active Electronically Scanned Array (AESA) radar system, the Advanced Targeting Forward-Looking InfraRed (ATFLIR), and the SHAred Reconnaissance Pod (SHARP) system. Future avionics upgrades will enable network-centric operations, enhancing situational awareness and the transfer of sensor data to remote command and control nodes. The *Super Hornet* will also assume the organic tanking mission vacated by the departure of the intrepid S-3B *Viking*.

EA-6B *Prowler*/EA-18G Airborne Electronic Attack/ USMC Joint EA Solution

The EA-6B *Prowler* has long served as the nation's foremost tactical electronic attack platform. In December 2001, the Navy completed an analysis of alternatives for Airborne Electronic Attack, laying the foundation to replace the *Prowler* with the EA-18G. Until then, investments in the ALQ-218 receiver system, which is the heart of the EA-6B Improved Capability III (ICAP III) program, will provide a critical technology bridge between the *Prowler* and the EA-18G. ICAP III and EA-18G are vital components of the Defense Department's plan to build a Joint "system-of-systems" electronic attack capability. IOC for the EA-18G is FY 2009.

The Marine Corps' Airborne Electronic Attack replacement aircraft has not yet been determined. Current plans have the Marines flying the EA-6B *Prowler* until 2015.


TODAY
2020
AV-8B
F-35B
F/A-18A/B/C/D
F-35C
F/A-18E/F
F/A-18E
F-14B/D
F/A-18F
S-3B
EA-6B
EA-18G

Joint-Unmanned Combat Air System (J-UCAS)

Naval Aviation is planning the development of a carrier-based, multi-mission Unmanned Combat Air Vehicle known as the Joint-Unmanned Combat Air System (J-UCAS). Equipped with intelligent autonomy technology, J-UCAS will require minimal operator intervention, normally for such things as mission planning inputs, updates, and target selection/weapons release approval. J-UCAS can be used for a wide variety of missions, including surveillance, reconnaissance, strike, and Suppression of Enemy Air Defenses (SEAD).

The program office is pursuing the design of two airframes, X-45C and X-47B, and detailed planning is now underway for a demonstration phase and follow-on operational assessment. Along with the goal of demonstrating a carrier-based multi-mission Unmanned Combat Air Vehicle (UCAV), the current program intends to develop a Joint C^4ISR and command and control architecture for the family of J-UCAS vehicles.

The J-UCAS surveillance variant has an expected IOC of FY 2015. The Strike/SEAD variant has an expected IOC of FY 2020.

Pioneer Unmanned Aerial Vehicle (UAV)

The *Pioneer* UAV System is a key asset for the Marine Corps. It provides near real-time ISR, including video imagery for artillery, air fires, and BDA over land and sea. Both the Navy and Marine Corps first deployed *Pioneer* in 1986.

The *Pioneer* Program sustains *Pioneer* and ensures its viability for the Marine Corps until a follow-on system is procured. The program will develop changes to the Ground Control Station, Launch and Recovery System, payload, and Air Vehicle (payloads, engine, avionics).

Eagle Eye UAV

The *Eagle Eye* UAV System is a tactical Vertical TakeOff and Landing (VTOL) ISR asset that is currently being developed by the United States Coast Guard in connection with its Integrated Deepwater System.

The Marine Corps views *Eagle Eye* as the best, near term UAV solution until a future Vertical Takeoff and Landing UAV (VUAV) is developed. *Eagle Eye* combines speed and endurance with a vertical takeoff and land capability that supports Expeditionary Maneuver Warfare.

Eagle Eye will fill capabilities gaps between *Pioneer's* sundown and the introduction of a future VUAV system. IOC is planned for FY 2009.

AH-1Z *Super Cobra* and UH-1Y *Huey* Helicopters

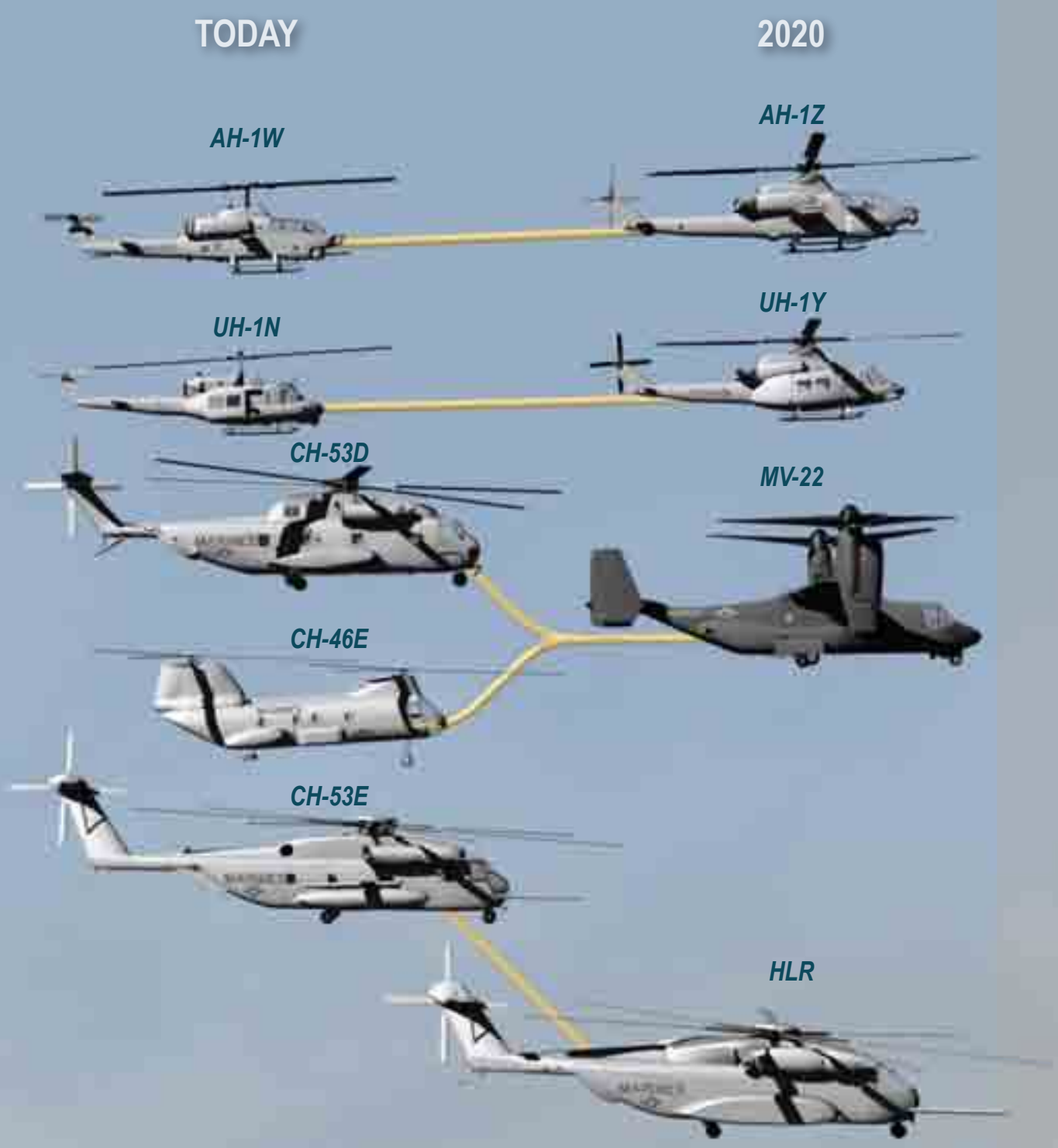
The H-1 upgrade program converts 180 AH-1W *Super Cobra* helicopters to the AH-1Z and buys 100 new-production UH-1Y *Huey* helicopters. Both aircraft feature the latest technology in rotor and drive train design, avionics, sensors, and weapons. They also share approximately 84 percent of their parts, making them far more maintainable, supportable, survivable, and deployable than current generation H-1 aircraft. IOC for the AH-1Z is FY 2011. IOC for the UH-1Y is FY 2008.

MV-22 *Osprey* Tilt Rotor

The MV-22 *Osprey* is a tilt-rotor Vertical/Short TakeOff and Landing (V/STOL) aircraft designed as the medium-lift replacement for the Vietnam-era CH-46E and CH-53D helicopters. The *Osprey* can operate as a helicopter or turboprop aircraft and incorporates advances in composite materials, airfoil design, fly-by-wire controls, and digital avionics. It possesses twice the speed, five times the range, and three times the payload of the CH-46, and will revolutionize 21st century expeditionary warfare. IOC for the MV-22 is FY 2007.

Heavy Lift Replacement (HLR) Helicopter

In operation since the early 1980s, CH-53E helicopters are now starting to reach their airframe fatigue life service limits. To keep the Fleet Marine Forces operationally effective through the 2025 timeframe, the Marine Corps is preparing to develop aircraft in the Heavy Lift Replacement (HLR) Helicopter configuration. Formerly known as the CH-53X, HLR has the expeditionary heavy-lift capability to meet the Marine Corps' specialized and unique requirements. HLR will feature high-efficiency rotor blades with swept cathedral tips, a common engine system, survivability enhancements, a Joint interoperable modern cockpit, a low-maintenance elastomeric rotor head, and an improved structure and drive train. The HLR program will improve operational capabilities and reduce life-cycle costs through operations and support cost reductions, increased range and payload, commonality with other assault support platforms, and digital connectivity and interoperability.


TODAY
2020
AH-1W
AH-1Z
UH-1N
UH-1Y
CH-53D
MV-22
CH-46E
CH-53E
HLR

E-6B *Mercury* Airborne Command Post

Derived from Boeing's 707 aircraft, the E-6B supports Sea Strike Strategic Deterrence. It provides the Commander, U.S. Strategic Command (USSTRATCOM) with the command, control, and communications capability needed to direct and employ strategic forces. Designed to support a flexible nuclear deterrent posture well into the 21st century, the E-6B performs Very Low Frequency (VLF) emergency communications, STRATCOM Airborne Command Post missions, and Airborne Launch Control of ground-based Inter-Continental Ballistic Missiles (ICBMs). It is the Navy's only survivable means of nuclear command and control.

The Block I modification program will improve capabilities and resolve deficiencies identified by STRATCOM. IOC is planned for FY 2010.

TODAY

2020

E-6B

TODAY

VXX Presidential Helicopter Replacement

Lockheed Martin's "U.S. 101" is in development as the replacement for the 20-year-old VH-60N and 30-year-old VH-3D helicopters, currently providing transportation for the President and Vice President of the United States, foreign heads of state, and others as directed by the White House Military Office. The U.S. 101 will have a hardened, mobile, command and control/transportation capability, and a system of integrated systems necessary to meet current and future presidential transport mission requirements. Performance, reliability, and systems technology will all be improved with the U.S. 101. IOC for the U.S. 101 is FY 2010.

2020

VXX

Broad Area Maritime Surveillance Unmanned Aerial Vehicle (BAMS UAV)

TODAY

The BAMS UAV fulfills multiple roles in support of Sea Power 21. Its capabilities include long dwell time on station, persistent ISR with worldwide access, and continuous open ocean and littoral maritime surveillance as far as 3,000 miles from the launch point. The BAMS UAV will operate above 40,000 feet and significantly enhance maritime connectivity, command and control, communications, and intelligence. It will complement platforms such as the P-8A Multi-Mission Aircraft (MMA) and Vertical Takeoff and Landing Tactical UAVs (VTUAVs). IOC for BAMS UAV is FY 2013.

*Artist's conception

P-8A Multi-Mission Maritime Aircraft (MMA)

The P-8A MMA will replace the P-3C *Orion*, which is approaching the end of its service life. The MMA's transformational, bottom-up design will integrate the aircraft's onboard mission suite with UAV-based and satellite-based systems and sensors. The P-8A will transform ASW and ISR warfighting by incorporating technological advances in networks, sensors, and communications. It will assure battle force access across the broad littoral, contributing to the Navy's ability to project power ashore. IOC for the P-8A MMA is FY 2013.

RQ-8B *Fire Scout* Vertical Takeoff and Landing Tactical UAV

The RQ-8B *Fire Scout* Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle (VTUAV) together with the MH-60R or MH-60S will provide organic Mine Interdiction Warfare (MIW), Surface Warfare (SUW), and ASW support to Littoral Combat Ships (LCS). *Fire Scout's* advanced sensors and systems will provide LCS with vital ISR, communications, and data link connectivity. IOC for the RQ-8B is FY 2008.

UAV Tactical Control System

Command and control of UAVs is accomplished through the Tactical Control System (TCS). TCS software will comply with the Defense Information Infrastructure/Common Operating Environment (DII-COE) and NATO standards for interoperability, so that data can be disseminated to Joint and service-specific C^4I systems. The interoperability and commonality of TCS will make future UAVs fully compatible with fielded combat systems, enabling connectivity with aircraft carriers, large-deck amphibious ships, command ships, and ground force commands.

MH-60R/S *Seahawk* Multi-Mission Combat Helicopter

The MH-60R and MH-60S multi-mission combat helicopters are the pillars of the Chief of Naval Operations' (CNO) Naval Helicopter Concept of Operations (CONOPS) for the 21st century. Under the "Helo CONOPS," the two *Seahawk* variants will deploy as companion squadrons embarked on aircraft carriers, surface ships, and logistics vessels under the leadership of the Carrier Air Wing Commander. The 85 percent commonality between the "R" and "S" variants will ease maintenance and logistics support.

MH-60R

The MH-60R will perform the Sea Shield mission, providing surface and subsurface warfare support with its Airborne Low Frequency Sonar (ALFS), Electronic Support Measures (ESM), Advanced Forward-Looking InfraRed (FLIR), precision air-to-ground missiles, machine guns, and lightweight torpedoes. IOC for the MH-60R is FY 2006.

TODAY

2020

RQ-8B

SH-60B

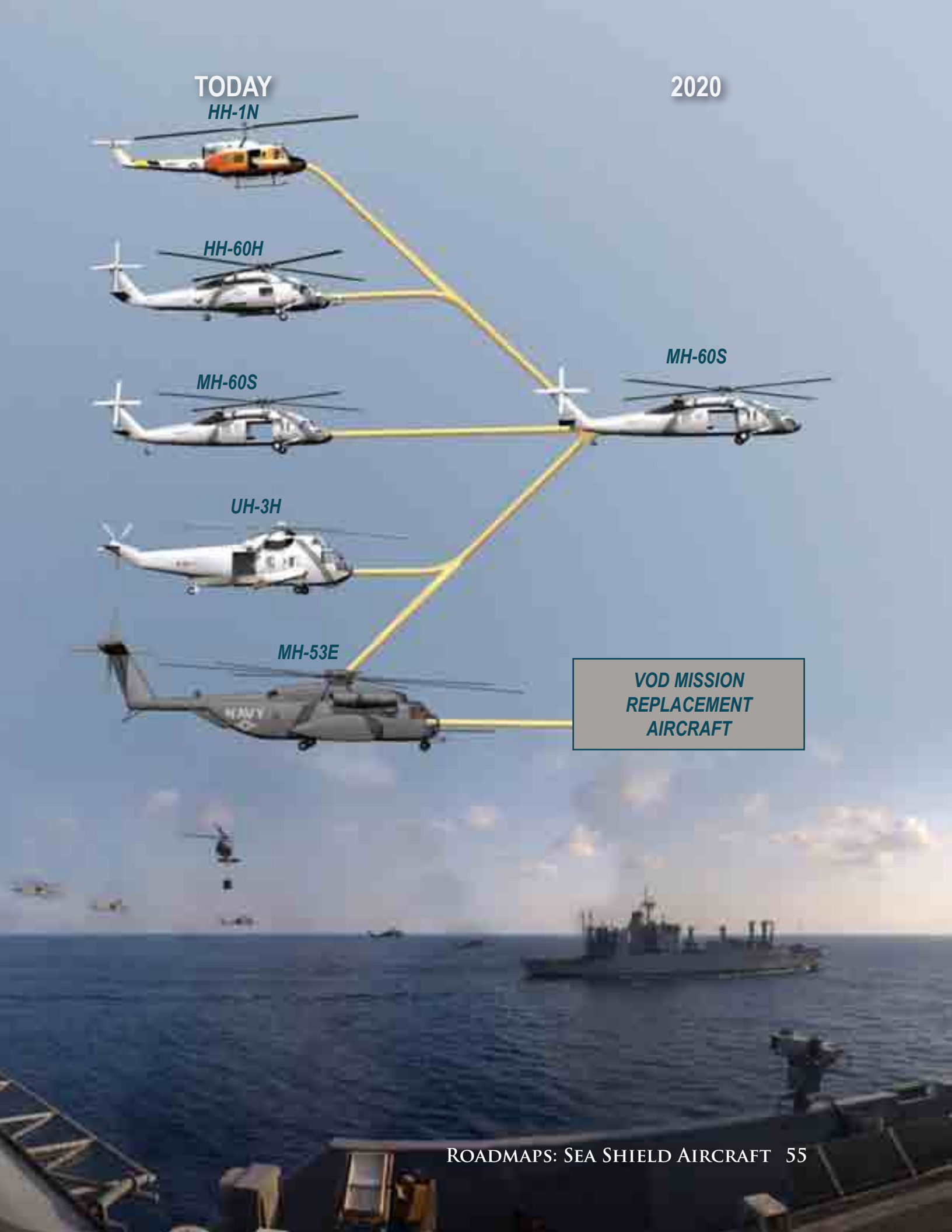
MH-60R

SH-60F

MH-60S

The MH-60S will partner with the MH-60R for surface warfare missions, carrying the same FLIR and air-to-ground weaponry and machine guns. Additionally, it will have the capability to support Combat Search And Rescue (CSAR) and Naval Special Warfare (NSW) Joint Theater operations. The platform will perform the Organic Airborne Mine CounterMeasures (OAMCM) mission using any one of five advanced sensor/weapons packages to provide detection, localization, and neutralization of anti-access threats. The MH-60S will also anchor the Fleet logistics role in CSG and ESG operations.

Whether or not the MH-53E will conduct dedicated Airborne Mine CounterMeasures (AMCM) depends on the performance of new generation AMCM systems being employed now by the MH-60S. The CVN Vertical Onboard Delivery (VOD) requirement is presently being evaluated. If substantiated, the MH-53E will retain the VOD role and eventually transition to another aircraft, possibly the HLR.


TODAY
2020
HH-1N
HH-60H
MH-60S
MH-60S
UH-3H
MH-53E
VOD MISSION REPLACEMENT AIRCRAFT

TODAY

C-9B / DC-9

C-40A

2020

Navy Unique Fleet Essential Airlift (NUFEA)

NUFEA aircraft provide Combatant Commanders with short-notice, fast-response, global logistics support. Currently comprised of several aircraft platforms, NUFEA assets deliver medium- and heavy-lift capability across short, medium, and long ranges. They are designed primarily to provide wartime movement of personnel and materiel and are force enablers integral to Sea Basing, because they support transitory beachheads by bringing personnel and equipment down the "last mile" of the logistics trail.

C-40A *Clipper*

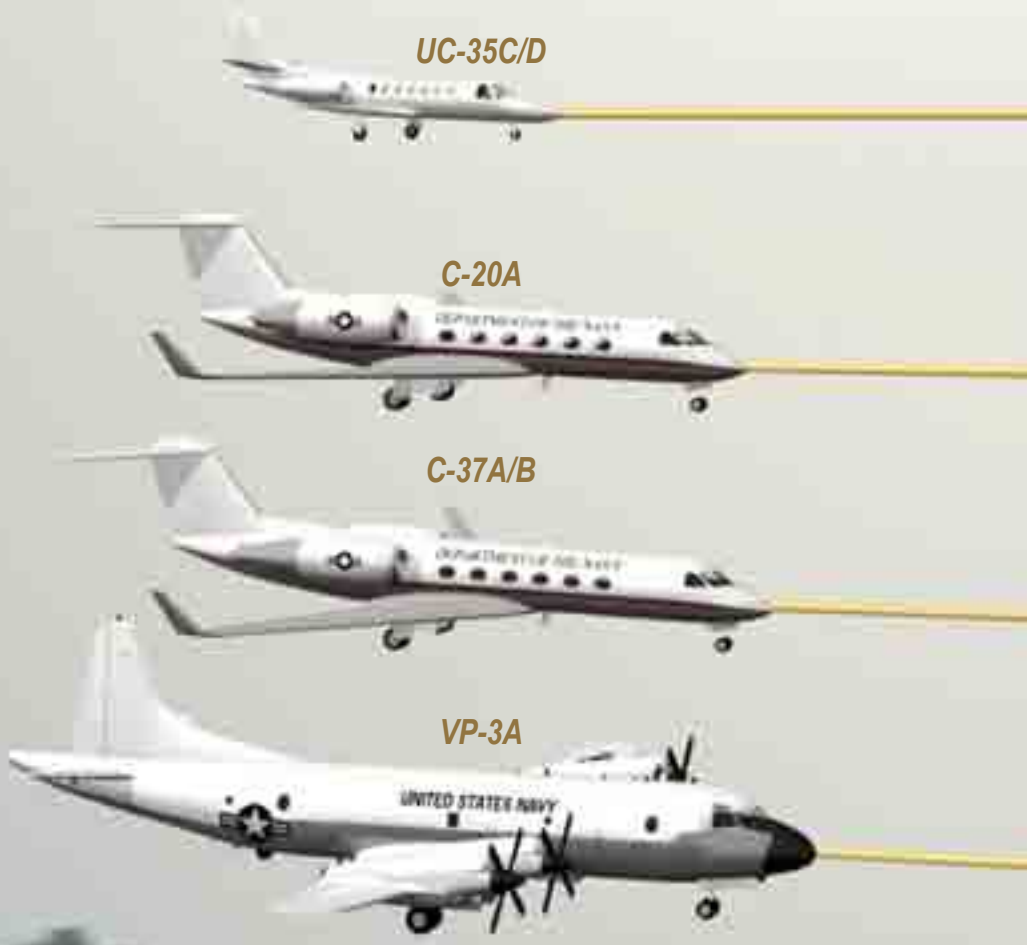
The C-40A *Clipper*, a Boeing 737 derivative with multi-passenger/cargo configuration combinations, will replace the aging C-9 *Skytrain* fleet. The venerable C-9 has served the Fleet exceptionally well for the past 30 years, but with an average aircraft age of 29 years, maintenance costs are steadily rising. The Navy will introduce the C-40A to lead the NUFEA contingent into the 21st century, with increased range, capacity, and fuel efficiencies to support sea-based logistics.

UC-35 Cessna *Citation*

The Marine Corps' UC-35 Cessna *Citation* is a derivative of the Model 560 *Citation V*, and is a medium-range support aircraft able to use short runways to move passengers or cargo with mission-sensitive requirements.

C-37 Gulfstream

The C-37 *Gulfstream* executive-transport aircraft replaces the aging VP-3A and C-20A to provide state-of-the-art, high-speed, long-range transportation for senior Navy Department personnel.



2020

C-37A/B

Other Transport Aircraft

The remaining transport aircraft, led by the venerable C-130T *Hercules*, and joined by the C-2, C-26, C-20D/G, and C-12, are stalwart performers and will continue to provide heavy, outsize and long-range lift capability well into the 21st century. Projected to receive the Avionics Modernization Program (AMP), the C-130 stands poised to enter the 21st century fully compliant with international standards and ready to meet the requirements of Combatant Commanders. A COD mission replacement aircraft, with an IOC of 2017, will replace the C-2A.

KC-130J *Super Hercules*

The KC-130J *Super Hercules* is a multi-role, multi-mission tactical tanker and assault support transport aircraft, well suited to the mission needs of the forward-deployed Marine Air-Ground Task Force. As the replacement for the aging KC-130F/R, the "J" model provides increased speed and range, an improved refueling system, a digital cockpit, night-vision systems capabilities, and increased survivability.


TODAY
2020
C-26D
UC-12B/F
C-2A
COD MISSION REPLACEMENT AIRCRAFT
C-20D/G
C-130T
KC-130T/J
KC-130F/R/T/J
993
UNITED STATES NAVY

E-2C *Hawkeye*/E-2D *Advanced Hawkeye*

Providing Airborne Early Warning (AEW), Battle Management, and Command and Control (C^2) for the CSG and Joint Commanders, the E-2C/D will remain a primary enabler of decisive power projection at sea and over land in the Joint operational environment. The latest variant of the E-2C, known as *Hawkeye 2000*, and the E-2D *Advanced Hawkeye*, a two-generation leap in systems capability, make the *Hawkeye* a critical node in network-centric air operations supporting Sea Shield and Sea Strike. *Hawkeye* system capabilities are fully interoperable with the E-3 *Sentry's* Airborne Warning And Control System (AWACS) and accompanying ground-based C^2 systems. Radar improvements coupled with Cooperative Engagement Capability (CEC) will make the E-2D an important participant in Theater Ballistic Missile and Cruise Missile Defense (TBMD/CMD) helping the CSG provide homeland/allied nation security and U.S./coalition force protection. IOC for the E-2D *Advanced Hawkeye* is FY 2011.

Aerial Common Sensor (ACS)

ACS is a cooperative development program with the Army and is designated to replace the EP-3E *Aries* aircraft. ACS mission systems will form a robust ISR capability using a combination of Signals Intelligence (SIGINT), Imagery Intelligence (IMINT), and Measurements and Signatures Intelligence (MASINT) in support of maritime, Joint, and national tactical and strategic objectives.

With its network-centric open architecture, ACS will function as a node of the Distributed Common Ground System-Navy (DCGS-N). Additionally, ACS will be enabled by a robust reach-back capability, increasing combat effectiveness through the use of off-board resources located ashore and afloat. ACS will ensure information dominance well into the 21st century in support of maritime and Joint forces. IOC for ACS is FY 2012.

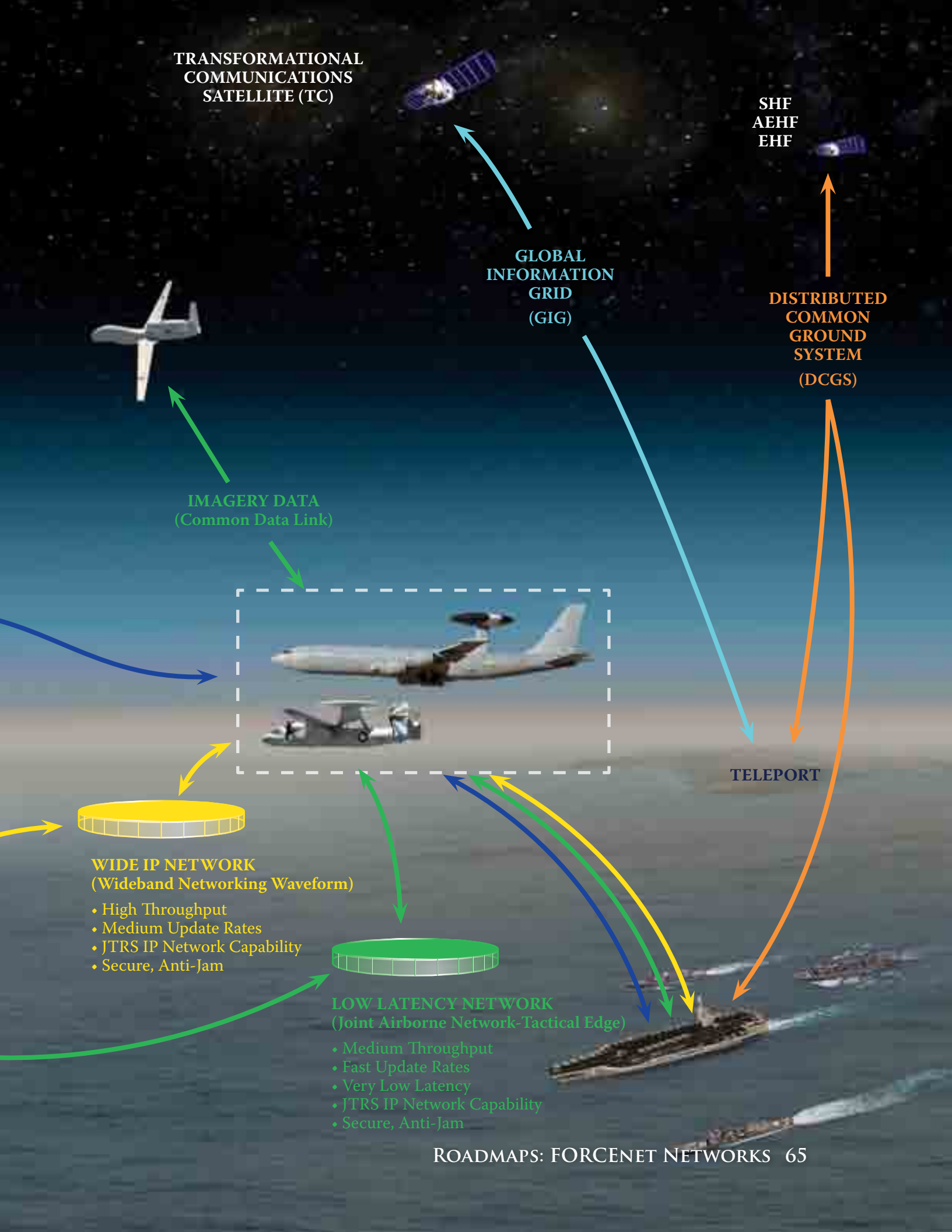

2020
E-2D
ACS

FORCEnet Networks

Networks that are interoperable with Joint forces will be fundamental to battlespace dominance, and FORCEnet will provide the architectural framework for that Joint interoperability. Naval Aviation and surface platforms will exchange images, signals, and data much the same way we do with the commercial Internet, speeding the flow of information to shorten the kill chain.

The Naval Information Grid, comprised of voice, video, data network, and information systems, will provide connectivity between surface, subsurface, and air warfare domains including access to Joint Services and the GIG. The Joint Airborne Network-Tactical Edge (JAN-TE) will provide airborne platforms with fast network entry and low latency communications to support high-speed, tactical aircraft and networked weapons.

A key program designed to enhance communications is the Joint Tactical Radio System (JTRS). JTRS is a DoD initiative that fulfills Joint Service communication requirements for Internet Protocol (IP)-based, software-programmable radio technology with a single (clustered) acquisition effort. JTRS will provide seamless, real-time interoperable voice, data, and video communications between Joint U.S. Warfighters, coalition forces, and allies.


TRANSFORMATIONAL COMMUNICATIONS SATELLITE (TC)
SHF
AEHF
EHF
GLOBAL INFORMATION GRID (GIG)
DISTRIBUTED COMMON GROUND SYSTEM (DCGS)
IMAGERY DATA (Common Data Link)
TELEPORT
WIDE IP NETWORK
(Wideband Networking Waveform)
• High Throughput
• Medium Update Rates
• JTRS IP Network Capability
• Secure, Anti-Jam
LOW LATENCY NETWORK
(Joint Airborne Network-Tactical Edge)
• Medium Throughput
• Fast Update Rates
• Very Low Latency
• JTRS IP Network Capability
• Secure, Anti-Jam

Persistent ISR

Naval Aviation will deny sanctuary to potential adversaries by providing the Joint Force Commander with extensive ISR through a combination of manned and unmanned aircraft positioned throughout the tactical battlespace. These platforms will employ sophisticated sensors that provide information on enemy activity to the Joint Force Commander, so that strikes can be planned and launched.

To achieve this, however, we must upgrade legacy networks and systems while developing and acquiring powerful new ones. Entirely new sensor systems are in development that will provide our ships, aircraft, and ground forces with the critical situational awareness they require. These efforts will provide a marked improvement in the sensor-to-shooter decision process fundamental to Sea Strike.

Distributed Common Ground System-Navy (DCGS-N)

DCGS-N merges ISRT (Intelligence, Surveillance, Reconnaissance, and Targeting), mission planning, and situational awareness. The core capability of DCGS-N is derived from the convergence of the Joint Fires Network (JFN) and the Joint Sensor Image Processing System-Navy (JSIPS-N). These two ISR systems interface with sensors and weapons systems to receive, display, correlate, fuse, and maintain geolocation track information on all forces on land, at sea, and in the air. Additionally, DCGS-N will be designed to accept ISR inputs from various Joint assets for intelligence, mission planning, and fire control/combat systems, providing a unique Time Critical Targeting (TCT)/Time Sensitive Strike (TSS) capability to units afloat and the Joint Forces Maritime Component Commander.

Common Data Link-Navy (CDL-N)

The Common Data Link-Navy (CDL-N) will be installed on aircraft carriers, amphibious warships, and amphibious command ships. The surface-mounted terminal receives signal and imagery intelligence data from remote sensors, and transmits link and sensor control data to airborne ISR platforms. The CDL-N system also links airborne ISR sensors and the shipboard processors of the DCGS-N and the Battle Group Passive Horizon Extension System (BGPHES)-Surface Terminal.

ATDLS Link-11/16

Link-16 is the primary Joint Tactical Data Link for the Department of Defense, and Link-11 is the common tactical data link for all U.S. Navy and allied ships not equipped with Link-16. In the interest of Joint interoperability, the Navy is installing Link-16 on most of its link-capable platforms. The Advanced Tactical Data Link System (ATDLS) program delivers Link-16 hardware to the Fleet and funds improvements.

Aircraft transmit and receive Link-16 information via the Multi-functional Information Distribution System-Low Volume Terminal (MIDS-LVT). The form-fit replacement for MIDS-LVT is MIDS-JTRS, which will be equipped with additional channel capability to host Link-16 and other JTRS waveforms. MIDS-JTRS will also support the eventual migration to IP-based networking.

Joint Mission Planning System (JMPS)

JMPS will replace the Tactical Automated Mission Planning System (TAMPS) and the Navy-Portable Flight Planning Software (N-PFPS). It integrates improved ISR with mission planning, significantly reducing the time required to execute tactical missions. JMPS and follow-on integrations offer important new features that extend the Navy's ability to plan and execute TACAIR operations.

Cooperative Engagement Capability (CEC)

The Navy's CEC system has significantly improved the CSG's air defense against the most sophisticated aerial threats. This system integrates the sensor data of each cooperating ship and aircraft into a single composite track picture—one with real-time, fire-control quality. CEC distributes sensor data on airborne threats to every ship in a strike group, extending the range at which hostile missiles and aircraft can be engaged to well beyond the radar horizon. When used in conjunction with the FORCEnet architecture, CEC will improve targeting against enemy air and land threats, as well as time-critical targets.

FORCEnet Sensors

Powerful, sophisticated, and linked sensors aboard highly survivable Naval platforms will provide the tactical knowledge necessary to accomplish Sea Strike and Sea Shield. Our Sea Warriors will operate these sensors in all dimensions of the battlespace, collecting and processing the data needed to formulate a complete tactical picture. Sensor data from disparate sources will enhance the ability to identify friendly and hostile targets in all environments, and information fusion will facilitate the intelligent management of Naval Aviation's vast sensor grid.

In the Radio Frequency (RF) spectrum, Navy and Marine Corps operators will enjoy a renaissance of radar system upgrades in nearly every mission area. Multi-function radars will transform into multi-function RF systems, capable of conducting radar search, electronic warning, communications, and electronic attack.

Multi-spectral and hyper-spectral systems technology will continue to mature, capitalizing on the entire Electro-Optical (EO) spectrum. Different spectrum wavelengths give Hyper-Spectral Imaging a greater degree of fidelity, making it ideal for locating camouflaged targets and providing a more complete picture of the battlespace. Active and modulated laser systems will enable improved pointing and the ability to process backscatter in obscured environments. Like the new RF systems, EO/InfraRed (IR) sensors will become multi-functional, performing navigation, threat warning, and targeting.

At the low end of the electromagnetic spectrum, magnetic anomaly detection sensors will leverage digital technology to double detection range and reduce false alarms. Future sensors leveraging laser technology will be 30 times more sensitive than existing sensors, enhancing detection and localization of underwater targets.

The future of ASW lies in distributed off-board sensing. Air-launched acoustic sensors will evolve from short-life tactical sonobuoys, to powerful, multifunction, long-life nodes of undersea sensor grids that can be delivered by manned aircraft or UAVs. Contact information will be passed directly to the GIG, creating a comprehensive undersea battlespace picture. Improved acoustic environmental sensing, modeling, and prediction capabilities will enable tailored sensor deployment to exploit the varying conditions of littoral waters.

Current, active, multistatic tactical sensing will improve with the Advanced Extended Echo Ranging (AEER) system. AEER incorporates a coherent active source along with sophisticated signal processing algorithms to reduce false alarms in shallow water environments, enhancing detection of slow and bottomed targets. This coherent source technology will also provide increased localization and attack capability in littoral regions.

The Compact Deployable Multistatic Receiver (CDMR) program will transform the AN/SSQ-101 Air Deployable Active Receiver (ADAR) sonobuoy into a multi-day, semi-autonomous active/passive receiver capable of Over-The-Horizon (OTH) communication and control. The companion Compact Deployable Multistatic Source (CDMS) program will produce a highly capable, air deployable, multi-day, coherent active source that also can be remotely commanded. With semi-autonomous operation and OTH connectivity, CDMR and CDMS will eliminate the need for continuous MPA presence to monitor and control sensor fields during multi-day surveillance operations.

Key Transformational Sensor Systems For Naval Aviation

ATFLIR is an infrared autonomous precision-targeting system that is being introduced into fleet F/A-18C *Hornets* and F/A-18E/F *Super Hornets*. It acquires, recognizes, and tracks air and surface targets with Global Positioning System (GPS)-level accuracy. ATFLIR replaces several older systems with a single pod that provides superior target recognition, image magnification, and standoff range.

The F/A-18E/F's AESA program increases air-to-air performance and provides important electronic warfare functionality. Phase I enhances air-to-air performance in hostile electronic countermeasures environments and in air-to-ground targeting. Phase II improves the targeting of hostile emitters and aircraft electronic protection and attack. Both phases allow air-to-ground autonomous targeting at standoff ranges. The Navy plans to upgrade AESA's reconnaissance features with Synthetic Aperture Radar (SAR) technology and other hardware and software improvements.

SHARP is a state-of-the-art tactical air reconnaissance system that replaces the Tactical Airborne Reconnaissance Pod System (TARPS). Installed on the centerline of the F/A-18E/F, SHARP will employ a suite of sensors to collect infrared, visible, and SAR digital imagery at medium and high altitudes, in all weather conditions. This will enhance Naval Aviation's capability to deliver weapons guided by GPS and digital imagery.

The Joint Signals Intelligence Avionics Family (JSAF) Block Modernization Program (JMOD) is a state-of-the-art "block-mod" program for the EP-3 *Aries II* aircraft. JMOD is an open-architecture system for intelligence collection and dissemination that builds on the connectivity of the Sensor System Improvement Program (SSIP). This program is upgraded incrementally during scheduled Depot-Level maintenance and will provide the *Aries* with a system that exploits threat emissions beyond the year 2020.

The Radar Modernization Program (RMP) on the E-2D *Advanced Hawkeye* represents a two-generation technological leap that will extend management of the tactical battlespace overland to a point far beyond the horizon. The advanced digital radar will provide precision air surveillance and increased reaction time, making it critical to network centric air operations. This system, when coupled with CEC, will fully integrate the E-2D *Advanced Hawkeye* into the dual role of TBMD/CMD. In cooperation with *AEGIS* cruisers and destroyers, and upgraded Standard Missiles (SM-2 Block IVA and SM-3), this capability allows the CSG to provide theater-wide cruise and ballistic missile defense for homeland/allied nation security and U.S./coalition force protection.

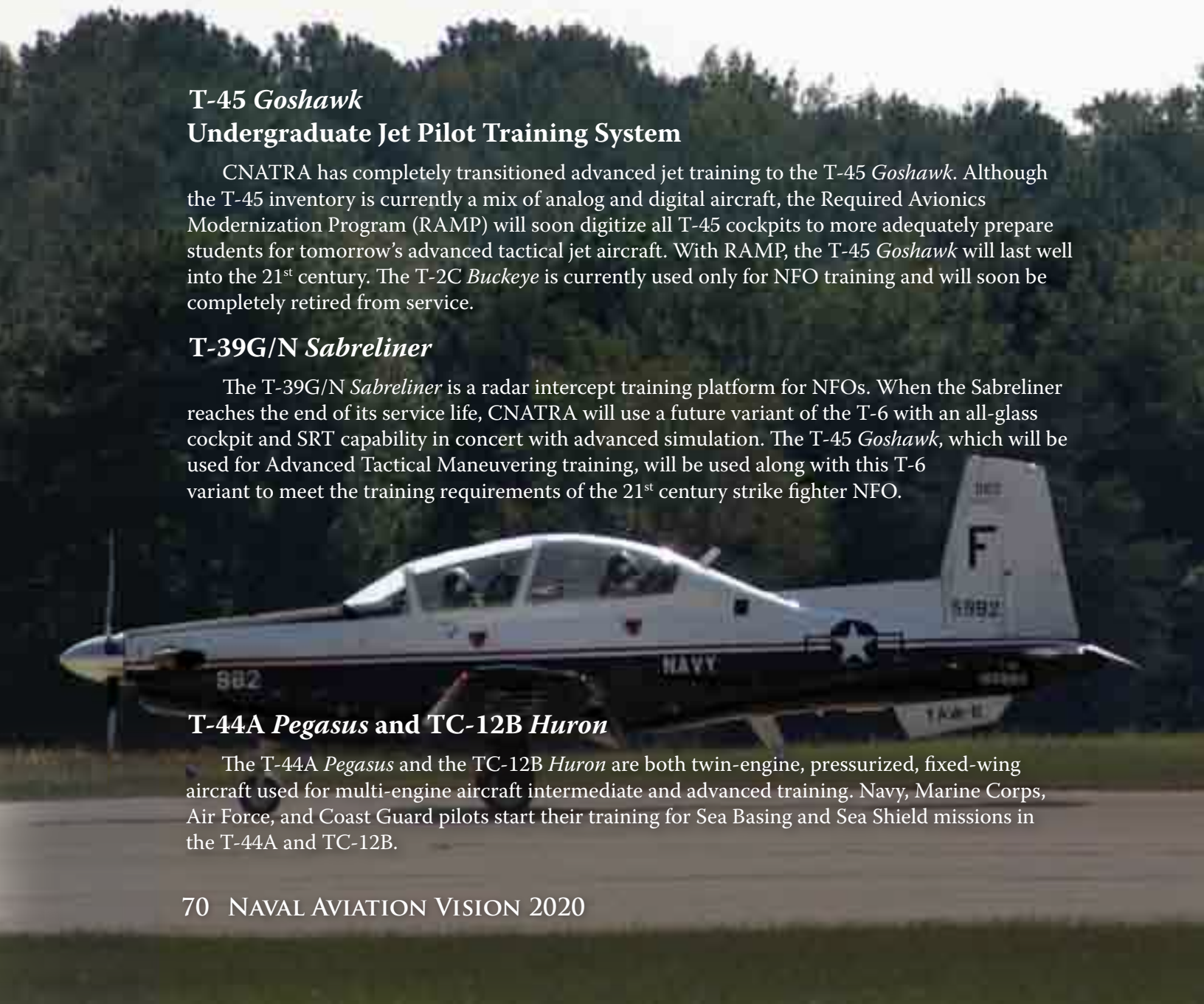
The AQS-22 ALFS will be installed in the MH-60R Multi-Mission Helicopter. An active/passive sonar system with 2,500 feet of cable, ALFS quadruples the area coverage of previously fielded dipping sonars.

Sea Warrior Aircraft Roadmap

The mission of the Chief of Naval Air Training (CNATRA) is on-time delivery of fully qualified Naval Aviators and Naval Flight Officers (NFOs), trained using leading-edge technology. This is the foundation upon which all of Naval Aviation's achievements rest in support of Sea Power 21. CNATRA's inventory includes basic propeller, helicopter, multi-engine, and advanced jet trainers.

T-6A *Texan* Joint Primary Training System

The first aircraft flown by aspiring Navy and Marine Corps pilots are the T-34C *TurboMentor* and the T-6A *Texan II*. The T-34C has served as the primary training platform for the past 25 years and by 2015 will be completely retired from the inventory. CNATRA is currently transitioning to the T-6A *Texan II*, a giant leap forward in primary training with a digital cockpit, ejection seats, cockpit pressurization, and significantly improved flight performance. A future variant, the T-6B, with an all-glass cockpit and Synthetic Radar Training (SRT) capability, is planned for the improved Joint NFO/Combat Systems Officer (CSO) training curriculum.



T-45 *Goshawk* Undergraduate Jet Pilot Training System

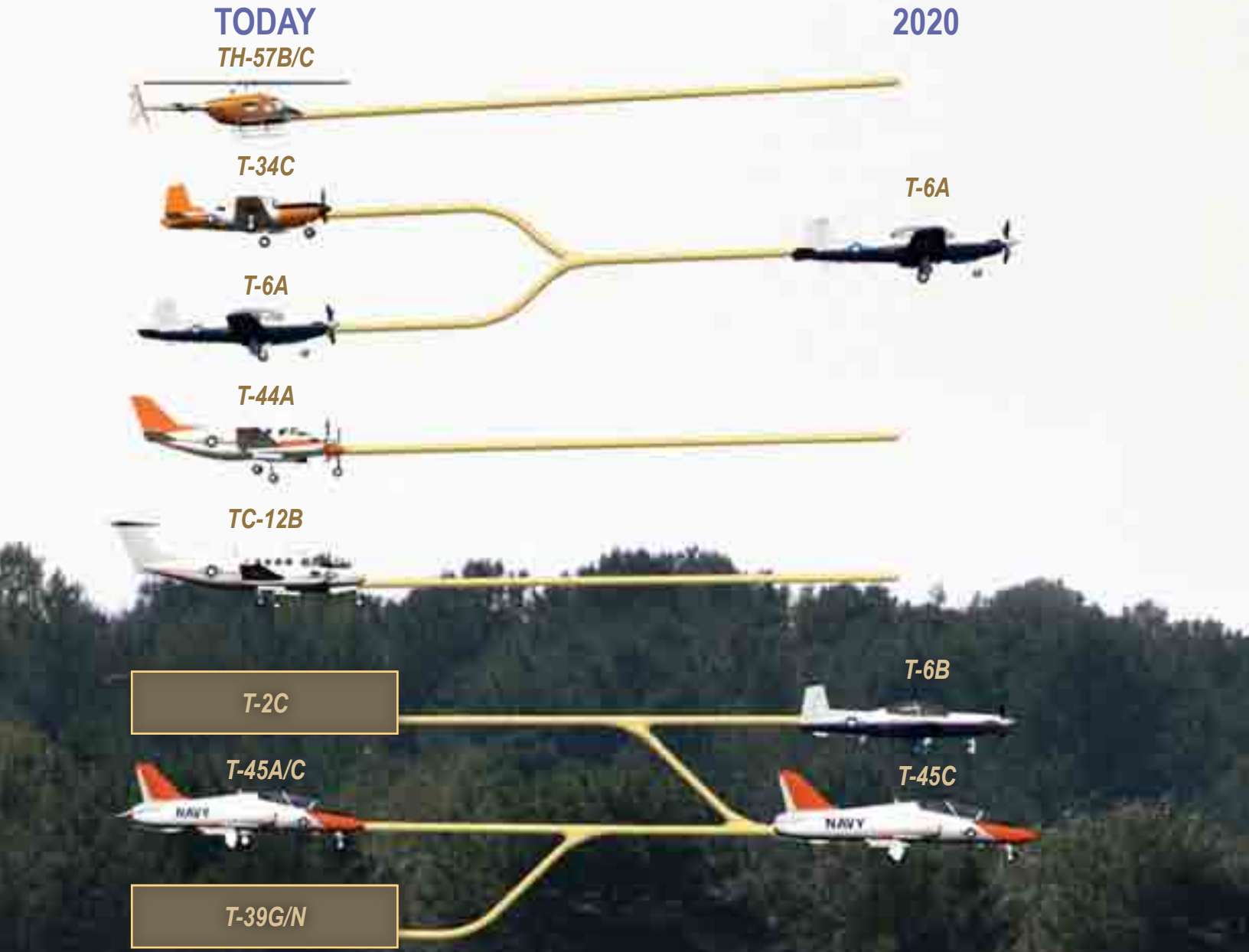
CNATRA has completely transitioned advanced jet training to the T-45 *Goshawk*. Although the T-45 inventory is currently a mix of analog and digital aircraft, the Required Avionics Modernization Program (RAMP) will soon digitize all T-45 cockpits to more adequately prepare students for tomorrow's advanced tactical jet aircraft. With RAMP, the T-45 *Goshawk* will last well into the 21st century. The T-2C *Buckeye* is currently used only for NFO training and will soon be completely retired from service.

T-39G/N *Sabreliner*

The T-39G/N *Sabreliner* is a radar intercept training platform for NFOs. When the Sabreliner reaches the end of its service life, CNATRA will use a future variant of the T-6 with an all-glass cockpit and SRT capability in concert with advanced simulation. The T-45 *Goshawk*, which will be used for Advanced Tactical Maneuvering training, will be used along with this T-6 variant to meet the training requirements of the 21st century strike fighter NFO.

T-44A *Pegasus* and TC-12B *Huron*

The T-44A *Pegasus* and the TC-12B *Huron* are both twin-engine, pressurized, fixed-wing aircraft used for multi-engine aircraft intermediate and advanced training. Navy, Marine Corps, Air Force, and Coast Guard pilots start their training for Sea Basing and Sea Shield missions in the T-44A and TC-12B.



TH-57B/C *Sea Ranger*

The TH-57B/C *Sea Ranger* remains as the Navy's sole, Primary Rotary Aircraft Training platform. Operating from Naval Air Station (NAS) Whiting Field, the TH-57B/C will continue its service for at least two more decades. Future upgrades to the TH-57 include a digital cockpit to enhance training and more closely match the capabilities of Navy and Marine Corps fleet helicopters.

Weapons Roadmaps

The Navy possesses over a dozen types of strike weapons in the categories of precision guidance, defense suppression, free-fall, and air-to-air. They facilitate Naval Aviation's ability to conduct missions in support of Sea Strike and Sea Shield.

Precision weapons increase the number of aim points per sortie and minimize collateral damage. They deny enemy sanctuary by destroying a wide number of moving and hardened targets. Standoff weapons, released outside point air defense zones, silently glide to impact, minimizing launch platform vulnerability. New technologies beyond the year 2010 include Directed Energy Weapons (DEWs) and High Speed Weapons (HSWs).

The following roadmaps show current and future air-to-air and air-to-ground weapons. Naval Aviation will consolidate existing inventories to save investment funds, reduce training requirements, and improve the agility of carrier operations.

AGM-84E *Harpoon*

Air-launched *Harpoon* is an all-weather, anti-ship cruise missile designed to destroy maritime targets. At ranges in excess of 67 nautical miles, the weapon employs a low-level cruise profile with inertial midcourse guidance and active radar terminal homing. The weapon weighs 1,523 pounds (with booster) and has a 500-pound blast fragmentation warhead. *Harpoon* is resistant to countermeasures and will remain in the inventory until the year 2015.

AGM-84H/K *Standoff Land Attack Missile-Expanded Response (SLAM-ER)*

SLAM-ER is a 1,488-pound weapon with a 534-pound warhead. It is a multi-mission weapon system designed primarily for surgical strikes against ships and high-value land targets. *SLAM-ER* provides a standoff strike capability in excess of 135 nautical miles, increasing the survivability of the delivery aircraft. It will destroy moving maritime and land targets, re-locatable land targets, and hardened/semi-hardened land targets. *SLAM-ER* precision guidance comes from GPS, an Inertial Navigation System (INS), and an Imagery InfraRed (IIR) seeker with a Man-In-The-Loop (MITL) system for terminal control. The Automatic Target Acquisition (ATA) feature reduces pilot workload by automatically acquiring the target and providing real-time targeting cues, guiding the weapon to impact.

R/UGM-109 *Tomahawk Land Attack Missile (TLAM)*

TLAM is an all-weather subsonic cruise missile that can be fired from surface and submarine platforms. It can carry a nuclear (Block II) or conventional (Block II/III) payload. Currently active in the Fleet are the conventional, land-attack, unitary, 1,000-pound-class warhead variant *(TLAM-C)* and the submunitions dispenser variant, with 166 combined-effects bomblets *(TLAM-D)*. A small cross-section, terrain-following capability, and low heat emission make the *Tomahawk* highly survivable during deep-strike missions.

The Block III *TLAM* has an improved engine for extended range, an insensitive warhead (in the 1,000-pound class), time-of-arrival control, and GPS navigation, which significantly reduces mission planning time and increases terminal accuracy. *Tomahawk* Block IV *(TLAM-E)*, also known as *Tactical Tomahawk*, has several enhancements including in-flight aimpoint re-targeting and mission adjustment, two-way satellite communications, onboard mission planning, the ability to loiter in a target area, and the ability to provide single-frame imagery of the target and battle damage indications. It costs 50 percent less than the Block III and has a 15-year recertification period (versus 8 years for the Block III). Formal Fleet introduction of *Tactical Tomahawk* occurred in September 2004.


TODAY
2020
HARPOON
SLAM-ER
SLAM-ER
TLAM BLK III/IV

AGM-88E *Advanced Anti-Radiation Guided Missile (AARGM)*

AARGM is an upgrade program to add multi-sensor and geo-specificity capabilities to the AGM-88 *High Speed Anti-Radiation Missile (HARM)*. This will enhance *HARM's* Time Critical Strike and Precision Attack capabilities. The *AARGM* upgrade includes: 1) a receiver for net-centric connectivity with off-board targeting information; 2) an advanced Anti-Radiation Homing Receiver coupled with conformal antennae for greater sensitivity; 3) expanded targeting capabilities and larger field of view to aid pilot situational awareness; 4) precision GPS/INS to help establish missile impact and avoidance zones; 5) an Active Millimeter Wave terminal radar to increase lethality against modern Air Defense Units (such as SAM radars that stop emitting); and, 6) advanced waveforms to counter Anti-Radiation Missiles (ARMs). The addition of a WIA transmitter will improve the ability to cue BDA.

The weapon's software fuses multiple sensors and expands *HARM's* capability to attack targets outside the typical electromagnetic spectrum. *AARGM* also enhances the Sea Strike capabilities of the F/A-18C-F and EA-18G aircraft by means of greater Enemy Order of Battle (EOB) Situational Awareness (SA) and Destruction of Enemy Air Defenses (DEAD). IOC for *AARGM* is FY 2009.

AGM-154 *Joint Standoff Weapon (JSOW)*

JSOW is a family of armaments that permit Naval aircraft to attack targets at increased standoff distances. The weapons use GPS and INS for precision guidance. All *JSOW* variants share a common body but can be configured for use against area targets or bunker penetration. One improvement under consideration is a seekerless unitary warhead that uses fused targeting data from airborne platforms to hit moving targets. Other improvements include real-time intelligence prior to launch and the transmission of a Weapons Impact Assessment (WIA) prior to detonation.


TODAY
2020
HARM BLK V
AARGM
JSOW A/C

Direct Attack (DA) Weapons

AGM-65 *Maverick*

Maverick is an air-to-surface tactical missile designed for CAS, interdiction, and defense suppression. It is effective against armored targets, air defense sites, ships, ground transportation nodes, and fuel storage facilities. *Maverick* uses infrared guidance and targeting and has two types of warheads: one with a contact fuse in the nose, and the other with a heavyweight warhead on a delayed fuse for target penetration prior to firing. The delayed fuse is very effective against large, hard targets. *Maverick* will remain in the inventory until the year 2015, or until the current supply (about 400) is exhausted.

GBU-10/12/16/24 *Laser-Guided Bombs (LGB)*

LGB is a Navy and Air Force joint effort, with the latter acting as the lead and executive service for procurement. *LGBs* include GBU-10, 12, and 16 that use MK-80/BLU series General Purpose (GP) bomb bodies, and GBU-24 that uses the BLU-109 bomb body incorporating state-of-the-art guidance and control features. GBU-12 is a 500-pound class weapon, GBU-16 is a 1,000-pound class weapon, and GBU-10 is a 2,000-pound class weapon. An *LGB* has a MK-80/BLU-series warhead fitted with a laser-guidance kit and Computer Control Group (CCG) mounted on the bomb nose. An electronic fuse housed in the aft section of the bomb body initiates the warhead. The seeker, housed in the CCG, senses laser energy and sends signals to the CCG canards to guide the weapon to the spot of reflected energy. Laser energy can be applied to the target by ground or airborne designators, or self-designated by laser-configured aircraft. *LGBs* will remain in the inventory until at least 2020.

GBU-31/32/38 *Joint Direct Attack Munition (JDAM)*

JDAM consists of GPS/INS guidance kits attached to GP bomb variants or the BLU-109 warhead. *JDAMs* address a wide number of fixed and re-locatable targets at ranges of 15 nautical miles from 40,000 feet. The weapon is autonomous, all-weather, and able to be re-targeted by the pilot prior to release. *JDAM* with GPS has an accuracy of less than 13 meters Circular Error Probable (CEP).

Advanced Precision Kill Weapon System (APKWS)

APKWS provides precision guidance to the existing 2.75 rocket system (scalable to 5.0 inch) for situations that do not require the use of a more expensive air-to-ground asset. It employs a semi-active laser and is accurate to within 2 meters of the aim point. The weapon will destroy target sets consisting of personnel, unarmored vehicles, lightly armored vehicles, APCs, structures, and MAN-Portable Air Defense Systems (MANPADS) at ranges from 1.5 to 5 kilometers. IOC for *APKWS* is FY 2008.

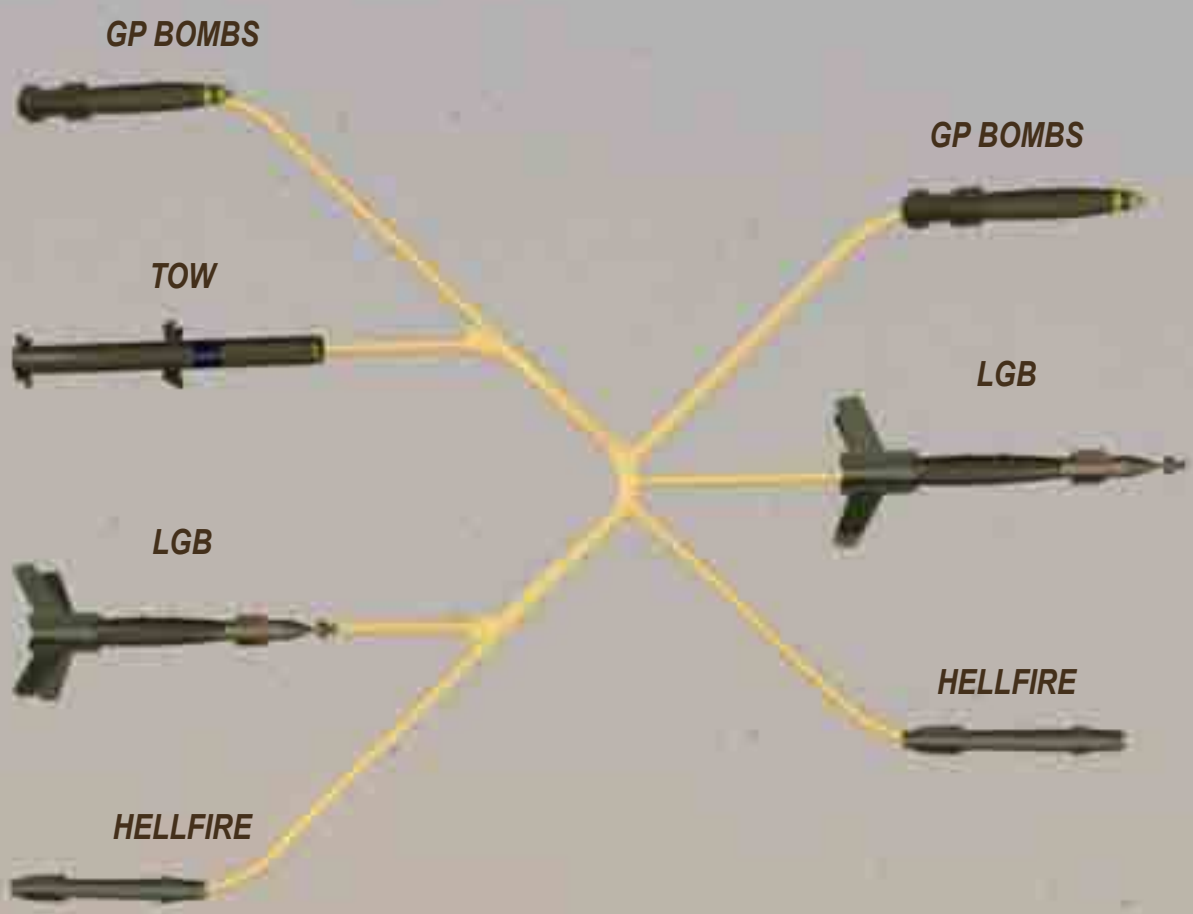

TODAY
2020
GP BOMBS
GP BOMBS
MAVERICK
LGB
LGB
JDAM
JDAM
2.75" & 5" ROCKETS
APKWS

Tube-Launched, Optically-Tracked, Wire-Guided Missile System (TOW)

TOW was designed to destroy enemy armored vehicles, non-armored vehicles, and crew-served weapons and launchers. It is an all-weather, command-to-line-of-sight, wire-guided weapon launched from the Marine Corps' AH-1W *Super Cobra* attack helicopter. *TOW* will remain in the inventory until the year 2015 or until the AH-1W helicopter is replaced by the AH-1Z. The latter will carry the *Hellfire* missile in place of *TOW*.

AGM-114 *Hellfire*

The *Hellfire* Air-to-Ground Missile System (AGMS) uses laser and radar frequency seekers to provide attack helicopters with a heavy anti-armor capability. The first generation *Laser Hellfire* is presently used as the main armament of the U.S. Marine Corps' AH-1W *Super Cobra* helicopter. *Laser Hellfire* homes on a laser spot projected by ground observers, other aircraft, or the launching aircraft itself, enabling autonomous, air or ground, direct or indirect, single-shot, rapid or ripple fire employment. *Hellfire* will remain in the inventory until the year 2020.


TODAY
2020
GP BOMBS
TOW
LGB
HELLFIRE
GP BOMBS
LGB
HELLFIRE

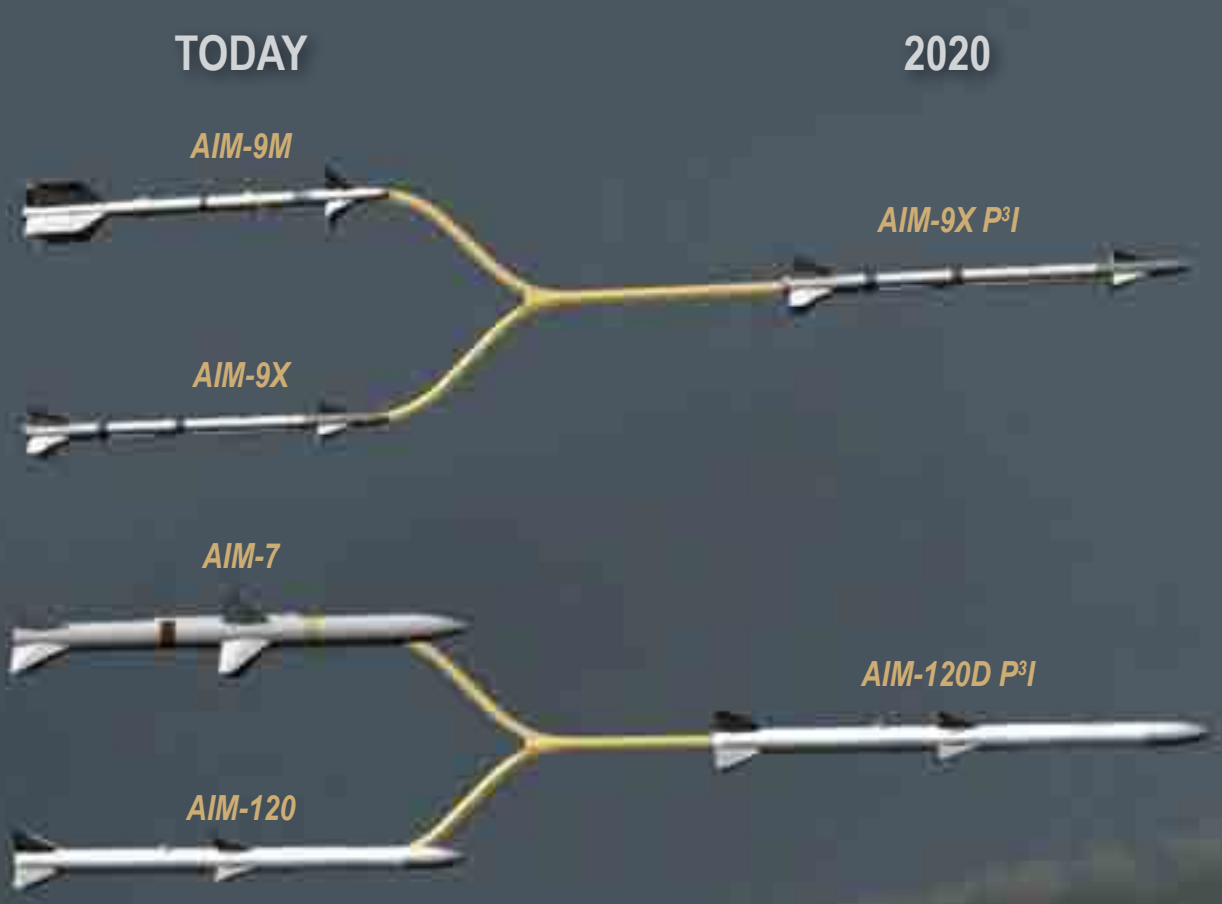
AIM-9X *Sidewinder*

The AIM-9X *Sidewinder* is a major modification to the AIM-9M short-range, air-to-air missile. It will provide U.S. fighters with air superiority over tomorrow's advanced threats. The AIM-9X is upgraded with a focal-plane-array guidance-control section, a highly maneuverable airframe, and signal processors that enhance kinematics and infrared countermeasure capabilities. The Joint Helmet Mounted Cueing System (JHMCS) provides a "first look, first shoot" capability to Naval Aviators.

AIM-120 *Advanced Medium-Range Air-to-Air Missile (AMRAAM)*

AMRAAM is deployed on the F/A-18A+/C/D *Hornet* and the F/A-18E/F *Super Hornet* and will be deployed on the EA-18G and *Joint Strike Fighter* aircraft. Joint Navy and Air Force procurement of *AMRAAM* continues and deliveries of the AIM-120C are under way. The AIM-120C Pre-Planned Product Improvement (P^3I) Program is a key factor in maintaining medium-range air superiority. This modernization plan includes clipped wings for internal carriage, a propulsion enhancement program, increased warhead lethality, and enhanced Electronic Counter-CounterMeasure (ECCM) capabilities through hardware and software upgrades. Ultimately, *AMRAAM* will be the Department of the Navy's sole Medium/Beyond Visual Range (M/BVR) missile.

The AIM-120C-7 configuration is a product of P^3I Phase 3 and is scheduled to achieve IOC in FY 2006. Continued procurement of the Joint *AMRAAM*, with a P^3I Phase 4 contract, will provide significant network-centric warfare capability, GPS, improved high-off-boresight capability, and missile kinematics. IOC for the Phase 4 *AMRAAM* is FY 2008.


TODAY
2020
AIM-9M
AIM-9X P³I
AIM-9X
AIM-7
AIM-120D P³I
AIM-120

Naval Aviation Science and Technology

The overarching objective of the Naval Aviation Science and Technology (S&T) Program is to ensure Maritime Aviation Supremacy against a broad range of current and future threats.

A successful S&T program requires continuous exploration, leveraging, and prioritization of emerging technology advancements across multiple government and industry sectors. Perhaps more importantly, it requires coherent strategy, processes, and measures to maintain a balanced portfolio of technology solutions, aligned with, and relevant to, known and projected threats.

A high rate of return on Naval Aviation S&T investments will be assured by strengthening partnerships and establishing collective agreements on realistic technology trajectories, both near- and far-term. The NAE will use the Navy's four enduring roles: Assurance and Deterrence, Command of the Seas, Power Projection, and Homeland Defense/Security, as well as the four pillars of Sea Power 21, as strategic filters to guide its efforts and effect measurable increases in the safety, agility, and combat effectiveness of our Sailors and Marines.

The NCDP provides capabilities gap assessments. These gaps present opportunities for near- and mid-term technology "hooks"—places where new and existing technologies can be inserted to solve issues identified by NCDP analysis. In this way, the NCDP serves as a realistic point of departure for future S&T planning and investment. We will actively partner with the Office of Naval Research (ONR), Navy Warfare Development Command (NWDC), Defense Advanced Research Projects Agency (DARPA), Joint Service and National Agencies, private industry, and academia in order to *harvest, integrate,* and *rapidly transition* transformational, evolutionary, and disruptive technologies to dramatically extend the combat power of our Naval Forces. Measures of effectiveness and cost will be used to construct a compelling business case for S&T investment that readily translates to today's challenges and provides for transformational capabilities to 2030 and beyond.

Science and Technology Strategy

The heart of ONR's S&T strategy is maintaining a healthy balance between "capabilities pull" and "technology push" that ultimately results in closing capabilities gaps on multiple planning horizons.

Direct Fleet involvement is essential to ensuring the relevance of candidate technologies, as well as inspiring and proving new concepts and "game changing" innovations (Tactics, Techniques, and Procedures (TTP)) that dramatically extend capabilities. NWDC serves as the Fleet's agent in developing future Navy concepts, as well as assessing the relevance of S&T projects against current operational concepts through Sea Trial experimentation.

ONR conducts basic, applied, and advanced technology research and development on behalf of the Navy and Marine Corps, with the goal of providing technology-based options for future maritime capabilities. In addition to inspiring and guiding long-term opportunities, ONR strives to insert mature technologies into development and acquisition programs that address current and emerging needs. The Chief of Naval Research (CNR) has full responsibility for planning, managing, and executing the Naval S&T portfolio in support of the Chief of Naval Operations and Commandant of the Marine Corps (CMC).

The Systems Commands (SYSCOMs) work in close partnership with NWDC and ONR to rapidly prototype promising new aviation concepts, tactics, and technologies; provide a quantitative "trade space" with decision support tools for prioritizing S&T investments; and develop realistic transition paths for the insertion of technologies into future aviation roadmaps. NAVAIR's unique facilities and expertise in high-fidelity modeling and simulation, for example, create a fully immersive experience for today's Sailors and Marines, enabling them to see a wide array of future capabilities and provide real-time input to shape concepts before they are integrated, flight-tested, and fielded. NAVAIR has also established key strategic partnerships with the Army, Air Force, and National Agencies to cooperatively develop advanced technologies and rapidly deliver Joint/Naval capabilities to the Fleet.

Science and Technology Current Readiness Initiatives

Two promising initiatives designed to assist today's Navy and Marine Corps are Tech Solutions and Swampworks.

Tech Solutions provides a direct connection between researchers and technologists, and Sailors and Marines, who can submit issues, problems, or ideas that impact their readiness and quality of service. The objective is to combine Fleet input with Naval research to provide a science and technology solution that meets or exceeds the requirement and is delivered to our operating forces within 12 months or less. This is accomplished several ways:

- Technology search and analysis services
- Rapid prototyping of technologies to meet specific requirements
- Demonstrations of available technologies and conceptual systems

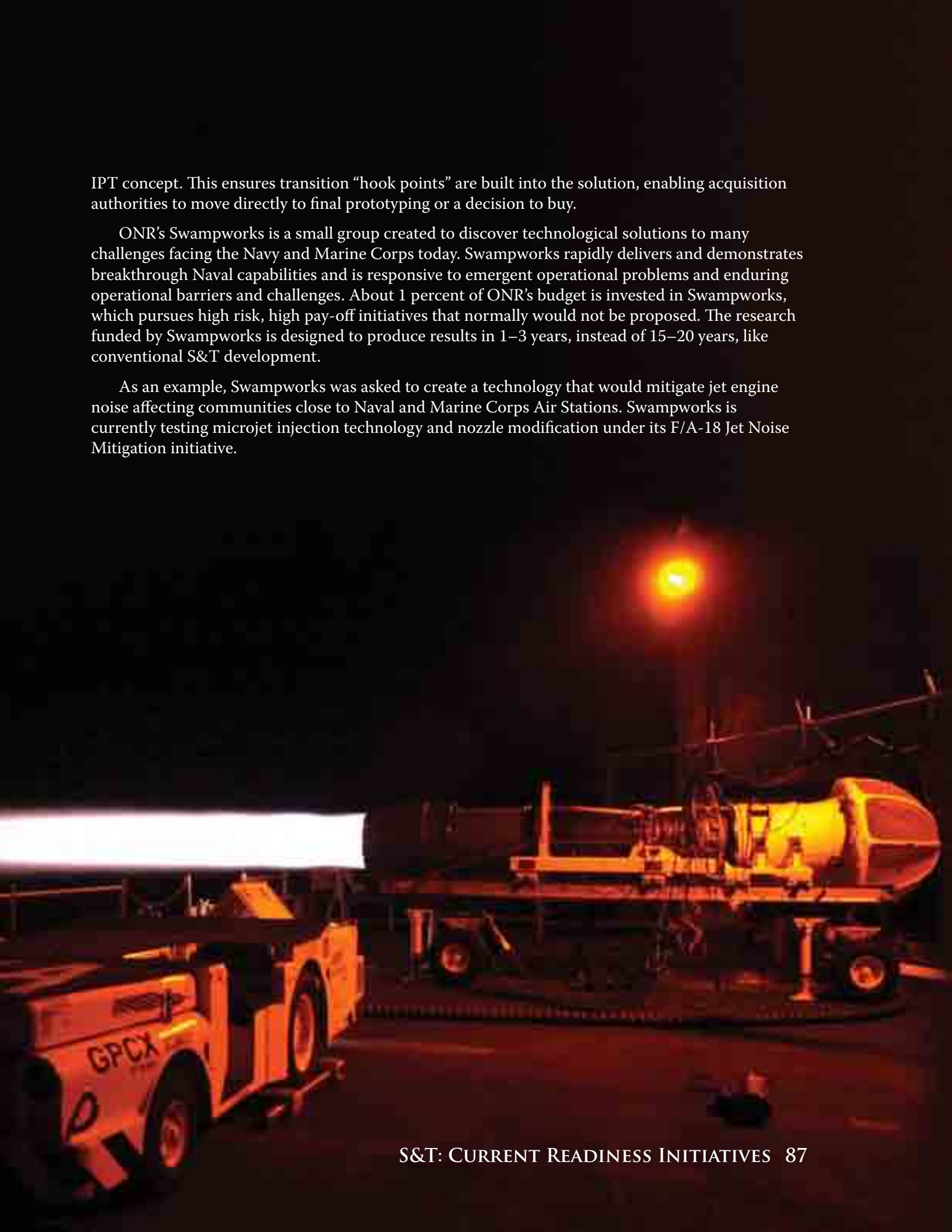
The goal of Tech Solutions is to provide Sailors and Marines with web-based access to the Naval Research Enterprise. This access, via both Internet and the Secret Internet PRotocol network (SIPRnet), targets E-4s to O-4s working at the deck-plate level on ways to improve mission effectiveness through the application of technology. Improvements from this effort are intended to enable more effective and efficient use of personnel.

Tech Solutions provides the Fleet with prototypes that deliver 50–70 percent solutions addressing immediate requirements that can easily be transitioned by the acquisition community. Every project is structured by definable metrics and includes appropriate SYSCOM elements in an

IPT concept. This ensures transition "hook points" are built into the solution, enabling acquisition authorities to move directly to final prototyping or a decision to buy.

ONR's Swampworks is a small group created to discover technological solutions to many challenges facing the Navy and Marine Corps today. Swampworks rapidly delivers and demonstrates breakthrough Naval capabilities and is responsive to emergent operational problems and enduring operational barriers and challenges. About 1 percent of ONR's budget is invested in Swampworks, which pursues high risk, high pay-off initiatives that normally would not be proposed. The research funded by Swampworks is designed to produce results in 1–3 years, instead of 15–20 years, like conventional S&T development.

As an example, Swampworks was asked to create a technology that would mitigate jet engine noise affecting communities close to Naval and Marine Corps Air Stations. Swampworks is currently testing microjet injection technology and nozzle modification under its F/A-18 Jet Noise Mitigation initiative.



Science and Technology Future Readiness Initiatives

The "Next Navy and Marine Corps," the forces that will emerge over the next 15-30 years, is the target of ONR's Future Naval Capabilities (FNC) efforts, where a great deal of ONR's transformational initiatives reside. The FNC program has recently aligned with the NCDP, which establishes FNC requirements and priorities for FORCEnet, Sea Strike, Sea Shield, and Sea Basing. Keys to successful transformation are the strategic alignment of near-term S&T priorities derived from capabilities gaps, and the development of robust business partnerships between Warfighters, Requirements Officers, Acquisition Professionals, and private industry.

Approximately two-thirds of ONR's Advanced Technology Development funds and about 40 percent of its Applied Research funds are invested in the FNCs. The FNC process delivers maturing technology to acquisition program managers for timely incorporation into platforms, weapons, sensors, and process improvements. Each of the FNC focus areas is planned and reviewed by an integrated team with representatives from ONR, the appropriate PEO, the Navy and Marine Corps requirements community, and the Fleet/Force user community. This provides regular validation of the relevance of candidate technologies and strong buy-in and commitment to transition plans.

Intelligent Engine Demonstrator

The missions and systems contemplated for future unmanned vehicles present unique challenges to today's propulsion and power designs. Future UCAV and ISR missions will place greater electrical power demands on the engine, while also requiring reduced fuel consumption, increased specific thrust, and reduced cost of ownership. These challenges are compounded by requirements for high altitude operation, long mission endurance, survivability, and providing power and thermal management for a new generation of electrically insatiable high-resolution sensors, advanced Electronic CounterMeasures (ECM), *More Electric* subsystem architectures

(including electric flight control actuation), and—potentially—the desire to carry DEWs. Meeting these challenges simultaneously demands an integrated, vehicle-level design approach to satisfy the energy management requirements of both propulsion and payload. An integrated power module approach combining propulsion, electrical power, prognostics and engine diagnostics, and thermal management services is the basis of the FNC Intelligent Engine Demonstrator. Several distinctive technology areas are being pursued under both the FNC and Joint Government/Industry Versatile Affordable Advanced Turbine Engine (VAATE) programs.

Heavy Lift Replacement Helicopter (HLR) Program

HLR is the follow-on to the Marine Corps' CH-53E Heavy Lift Helicopter. It will have high-efficiency rotor blades with swept cathedral tips, a common engine system, survivability enhancements, a Joint interoperable modern cockpit, a low-maintenance elastomeric rotor head, and an improved structure and drive train. Commonality between other USMC aircraft in terms of engines and avionics will also greatly enhance the maintainability and deployability of the aircraft.

Improved rotor performance must be developed without increasing rotor diameter, which is limited by shipboard spotting constraints on today's amphibious assault ships. NAVAIR is conducting an investigation focused on improving the accuracy and efficiency of rotorcraft hover and forward flight performance in a project titled, "Heavy Lift Rotorcraft Advanced Aero Modeling." Under this investigation, NAVAIR is pursuing several performance-enhancing technologies such as non-linear twist distribution, advanced airfoils, unconventional tip planform geometries, increased blade number, passive high-lift devices, reconfigurable rotors, and active controls.

NAVAIR's heavy lift investigation will facilitate the design of advanced high-performance rotors through the development of a new class of practical, computational fluid dynamics-based engineering analysis and design tools. These tools will significantly reduce the cost, risk, and amount of wind tunnel time needed to optimize advanced rotor blade designs and substantiate their performance.

The "Navy & Marine Corps After Next"

The "Navy and Marine Corps After Next" is the operational force we will see in 15-30 years. On this planning horizon, ONR is conducting exploratory and advanced development research in multiple fields, especially in areas that are "Navy and Marine Corps-unique."

Unique Naval Aviation Technology Areas are fields in which Naval Aviation is the only significant U.S. sponsor. It is vital to keep such fields healthy to outpace our adversaries and avoid technological surprise. A broad U.S. Naval Aviation mission, accomplished in challenging operating environments, dictates unique technical requirements different from those of other air forces. ONR is investing in several Naval Aviation technologies, including:

- Materials
- Structures
- Flying Qualities and Performance
- Propulsion and Power Systems
- Ship/Ground Aviation Systems
- Avionics
- Weapons Engineering/Energetics
- Human Systems

Sea Strike Initiatives and Areas of Interest

High Speed Weapons (HSWs)

Naval Aviation planners are interested in the development of High Speed Weapons (HSWs) capable of operating from high supersonic speeds (Mach 3-4) to hypersonic speeds (Mach 5 and above). Typically viewed as long-range weapons, ONR has invested funds in developing the structures, materials, propulsion, and inlet/nozzle technologies needed for such highly integrated, volume-constrained systems. Development of these weapon systems supports the National Aerospace Initiative (NAI) mission of sustaining America's aerospace leadership with an integrated, capability-focused, national approach enabling High Speed/Hypersonic (HS/H) flight.

The immense velocities achieved by HSWs will reduce the kill-chain time for Time Sensitive Strike (TSS) and increase the probability of penetrating hard and deeply buried targets. Within a decade, we expect to improve the CSG's current precision-firing capability from a few hundred aim points per day to over five times that many. Commanders on the ground will gain a tremendous advantage from the enhanced strike ability of sea-based aircraft. When combined with the other elements of CSGs and ESGs, it will allow ground commanders to integrate fires with maneuver, enhancing the strategic deterrence of our forward-deployed Naval forces.

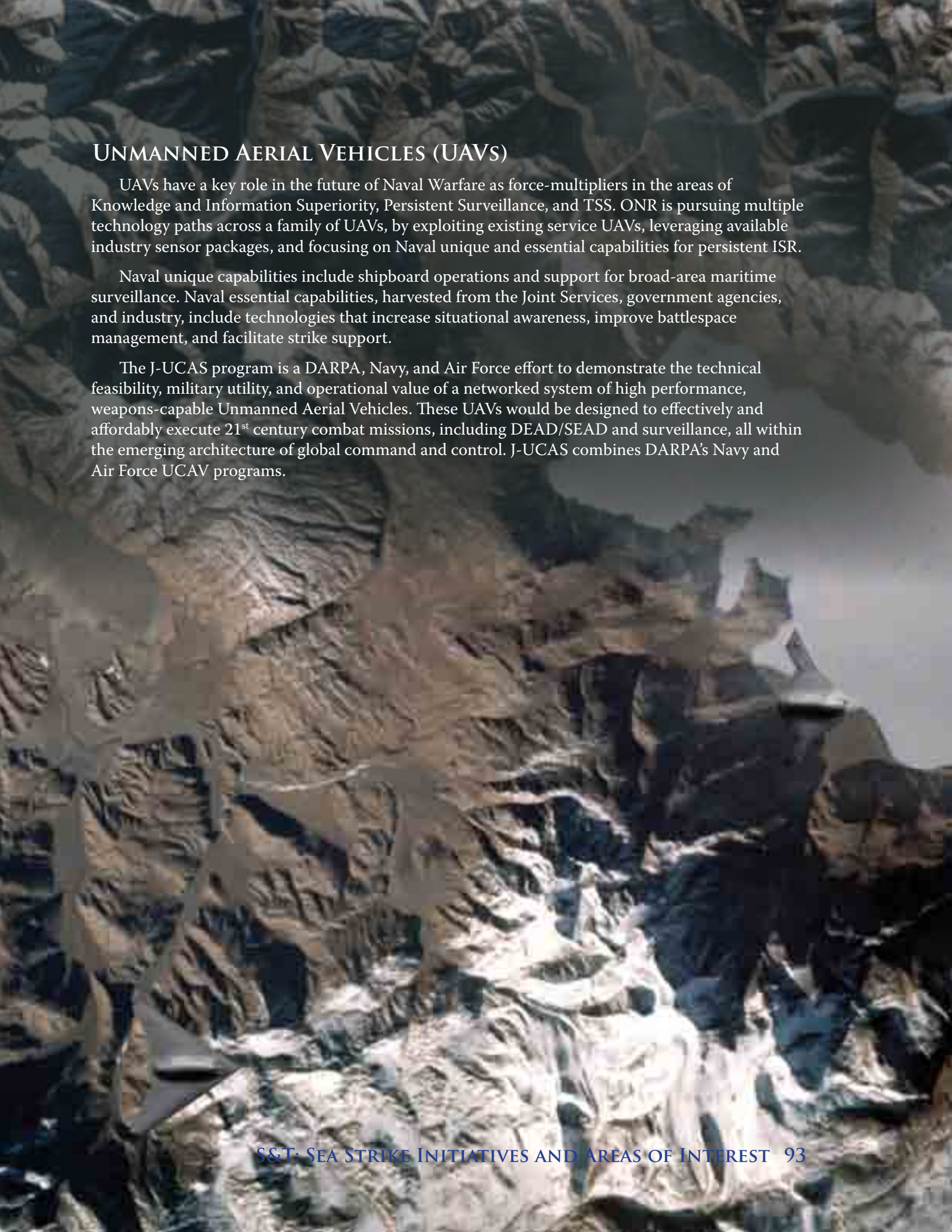
Directed Energy Weapons (DEWs)

Advancements in High-Power Microwaves (HPMs) and High Energy Lasers (HELs) have created a new class of weapons systems known as Directed Energy Weapons (DEWs). DEW systems will precipitate a revolution in future engagements, employments, and concepts of operations.

HPMs flood target areas with energy, allowing multiple and simultaneous target engagements. HPMs affect the target internally, by electrical disruption. Conversely, High Energy Lasers (HELs) provide precise, long-range laser targeting for surgical strikes, effective whether the laser is on the ground, at sea, in the air, or in space. Future manned and unmanned aircraft can be expected to deploy DEWs and targeting systems.

HELs offer great promise for ASW and Anti-Surface Warfare (ASUW) missions. Because HELs offer extremely precise targeting, hostile craft can be engaged even with friendly forces in the vicinity. Solid-state lasers facilitate multiple target engagements without the requirement to rearm, and when coupled with high-performance gimbal systems, provide extremely rapid response. And because lasers are invisible, the enemy will not immediately know the origin of the attack.

Using HELs for Anti-Air Warfare (AAW) could change the balance of air power, helping the U.S. achieve airspace dominance offensively. They could also be used defensively to destroy incoming air-to-air missiles, expanding the role of non-fighter aircraft during wartime operations and eliminating the need for fighter escorts.



Unmanned Aerial Vehicles (UAVs)

UAVs have a key role in the future of Naval Warfare as force-multipliers in the areas of Knowledge and Information Superiority, Persistent Surveillance, and TSS. ONR is pursuing multiple technology paths across a family of UAVs, by exploiting existing service UAVs, leveraging available industry sensor packages, and focusing on Naval unique and essential capabilities for persistent ISR.

Naval unique capabilities include shipboard operations and support for broad-area maritime surveillance. Naval essential capabilities, harvested from the Joint Services, government agencies, and industry, include technologies that increase situational awareness, improve battlespace management, and facilitate strike support.

The J-UCAS program is a DARPA, Navy, and Air Force effort to demonstrate the technical feasibility, military utility, and operational value of a networked system of high performance, weapons-capable Unmanned Aerial Vehicles. These UAVs would be designed to effectively and affordably execute 21st century combat missions, including DEAD/SEAD and surveillance, all within the emerging architecture of global command and control. J-UCAS combines DARPA's Navy and Air Force UCAV programs.

Sea Shield Initiatives and Areas of Interest

Theater Air and Missile Defense (TAMD)

TAMD forms a protective umbrella against aircraft and ballistic/cruise missile threats. The protection extends over the horizon or deep inland, from ground level to the upper atmosphere.

The CEC will network digital radar data from the E-2D *Advanced Hawkeye* and surface units in the battle force. When CEC and Marine Air Ground Task Force (MAGTF) capabilities are networked with the new over-the-horizon Surface-to-Air (SM-5) missile, an integrated and seamless air defense is created that can engage airborne targets at long range, over land and sea. The ability to form a Single Integrated Air Picture (SIAP), using Joint track data, will tremendously improve tactical decision speed, accuracy at extended ranges, and increase the number of engagement opportunities.

TAMD also allows us to transform our force doctrine. Commanders can reassign manned aircraft from defensive air patrol duties to strike missions, and vice versa. Another option would be to reassign *AEGIS* guided-missile destroyers from close-in force defense to distant ballistic missile defense stations, or to conduct precision surface-fire strikes. With the development of the Volume Search Radar, extended-range air defense will be enhanced. It provides integrated, hemispheric search coverage in the battlespace and will be installed on the *CVN 21*-class and the next generation of surface ships.

Sea-based Ballistic Missile Defense (BMD) systems will exploit the existing infrastructure of Naval radars and missile launchers, lending flexibility to theater and homeland missile defense operations. FORCEnet will defend against theater-range missiles by linking our sea-based interceptor missiles to a space- and air-based sensor network and C^2 systems. *USS LAKE ERIE* (CG-70) has conducted several BMD tests and launchings, making ballistic missile defense a near-term reality.

Littoral Sea Control

Littoral Sea Control assures access and maneuvering freedom for Joint forces deploying from the sea base. We will defeat anti-access assets such as small, "swarming" surface craft, quiet diesel submarines, and sea mines through a combination of surface, subsurface, and aviation assets. The command and control of such missions will be vastly improved through netted assets that link our attack forces to sensors, decision aids, and displays.

Anti-Submarine Warfare (ASW)

The objective of ASW is to gain maritime superiority by finding, destroying, and, when necessary, avoiding enemy submarines. The modern diesel submarine, far quieter than its predecessors, is well suited for the mission of area denial. We can expect our adversaries to use diesel submarines in the littorals, where shallow waters are noisy and cluttered. Consequently, we must leverage advanced technologies to improve wide-area surveillance, detection, localization, tracking, and attack of underwater threats.

Manned and unmanned aircraft—by virtue of their speed, area of coverage, versatility and payload—will continue to be indispensable against the submarine threat. The P-3C, with its Anti-Surface Warfare Improvement Program (AIP), and the P-8A MMA will fulfill multiple roles in ASW and ASUW to assist CSG and ESG Commanders. The Navy is developing the ALFS to increase the acoustic capabilities of ship-based MH-60R helicopters. The Automatic Radar Periscope Detection System, which can be installed on aircraft and surface ships, will be used to detect exposed enemy periscopes. Over the long term, research efforts will be focused on developing active and passive EO systems for manned aircraft and UAVs.

Mine Countermeasures (MCM)

Effective MCM keeps the seaways open by neutralizing enemy mines that hinder free movement. We will work to develop new mine detection and clearance systems, including systems organic to forward-deployed combat ships and the Littoral Combat Ship (LCS). Both the MH-53E and organic MH-60S AMCM helicopters will employ various mine hunting, sweeping, and neutralization weapon systems to rapidly localize and mitigate the sea mine threat to Naval and commercial shipping. These sophisticated, networked craft will patrol air, surface, and sub-surface mediums. New MCM technologies and advanced detection systems, such as multi-spectral electro-optics and laser detection, may be deployed on patrol aircraft, helicopters, and UAVs to support future Naval operations.

Airborne Mine Countermeasures Systems (AMCM)

Carried into combat by MH-60S *Seahawk* helicopters, five next-generation AMCM weapon systems will provide the CSG/ESG with an organic capability to locate and neutralize sea mines. These systems include the AQS-20A mine hunting sonar, Airborne Laser Mine Detection System (ALMDS), Airborne Mine Neutralization System (AMS), Rapid Airborne MIne Clearance System (RAMICS), and Organic Airborne and Surface Influence System (OASIS). Collectively, they will facilitate unfettered operations between the shallow water littoral environment and blue water. These new capabilities, organic to deployed Naval forces, will work in conjunction with other MCM assets, and increase our Navy's ability to maneuver in potentially mined areas during combat.

Homeland Defense/Security

Sea Shield extends homeland security to the fullest extent through a national effort that will integrate forward-deployed Naval forces with the Joint Services, civil authorities, intelligence, and law-enforcement agencies.

Working with the newly established U.S. Northern Command, we will identify, track, and intercept dangers long before they threaten our homeland. This will extend the security of the United States far seaward, taking advantage of the time and space afforded by Naval forces to shield our nation from impending threats. Naval aircraft such as the P-8A MMA, the E-2C *Hawkeye,* the E-2D *Advanced Hawkeye*, and the BAMS UAV, will provide comprehensive situational awareness to cue allied and Joint service interceptors. Additional concepts involve installing advanced sensors on blimps and other Lighter Than Air (LTA) vehicles.

We are also exploring ways to process and display the vast quantities of intelligence data within the maritime battlespace. To create actionable "Maritime Domain Awareness," we are developing automated systems that will assimilate, correlate, and display the data, then share the information with the relevant authorities. This concept embodies FORCEnet and will provide global reach into the GIG-ES to ensure the timely interdiction of suspicious vessels and aircraft.

Force Entry Enabling

Force Entry Enabling is a key component of Sea Shield. Our future adversaries know from OEF/OIF that it is in their best interest to strike before U.S. forces enter the battlespace. To do this, they will need a strong ISR capability coupled with the ability to strike U.S. logistics centers. Sea Shield assets counter this threat by providing vital escorting and traditional sea control roles. Naval Aviation will operate in concert with Sea Shield forces to engage the enemy as rapidly as possible and provide vital ASW and mine countermeasures support with MPA, helicopters, and UAVs.

Sea Basing Initiatives and Areas of Interest

Airships

Recent advancements in materials and propulsion technologies make airships and LTA vehicles a realistic, cost-effective, low-risk option for Force Protection and Logistics/Heavy Lift Sea Basing. Airships are capable of maintaining a stationary orbit and providing constant coverage and continuous situational awareness for deployed forces. Supporting the Navy's Sea Base, airships could transport materiel and equipment across international distances, possibly landing on water and mitigating the challenges of limited forward basing. Airships are stable, survivable, and cost-efficient to operate.

Seaplanes

With their ability to land and take off from both land and water, manned and unmanned seaplanes are promising candidates for connecting the Sea Base with the shore. This amphibious transport aircraft would be based on the synergy between extreme Short TakeOff and Landing (STOL) aerodynamics and advanced planing hydrodynamics. Other technologies would include advanced propulsion, sensors and processing, and composite structures. Seaplanes would boast a payload weight and volume similar to the C-130 and could operate from both water and unimproved airfields.

Sea Trial Initiatives and Areas of Interest

Sea Trial streamlines and integrates the Navy and Marine Corps experimentation process, putting the Fleet at the heart of innovation. Its aim is to speed prototyping, enrich concept development, and coordinate experimentation more fully. Under Sea Trial, we will "push" forward basic research, science, and technology, and "pull" from documented warfighting requirements in order to develop and acquire new systems. Our research, science, and acquisition communities will monitor and support promising technologies, then incorporate these technologies into advanced systems that we will deliver to the Fleet Warfighter.

Initiatives already conducted under the umbrella of Sea Trial include Link 16 upgrades, P-3 Satellite Communication (SATCOM) and acoustic data links, precision fires data links, and the Global Hawk Maritime Demonstration. Sea Trial is currently emphasizing the testing of netted data and information systems in support of the CNO's goal of a networked Naval force. Other areas of interest include accelerating the prototyping and experimentation of unmanned Naval vehicles (air, surface, and sub-surface).

The Sea Trial process will develop enhanced warfighting capabilities for the Fleet by more effectively integrating the thousands of talented and energetic experts, military personnel, and civilians who serve throughout our Navy and Marine Corps. Working together, they will fulfill the promise of Sea Power 21.

The Fleet's Role

Although the Commander, U.S. Fleet Forces Command (CFFC) provides the overall guidance for Sea Trial, and the Navy Warfare Development Command (NWDC) serves as Project Coordinator, the operational Fleets play major roles in the program. Second Fleet supports Sea Strike and Sea Basing initiatives and Third Fleet supports Sea Shield. The Naval Network Warfare Command (NETWARCOM) manages all FORCEnet-related Sea Trial initiatives. The Fleets are each responsible for their respective experimentation plans and Fleet collaboration teams established at each unit will lead the Sea Trial process.

Fleet Support

The Office of the Chief of Naval Operations (OPNAV) and the SYSCOMs will integrate Sea Trial into various acquisition strategies. Risk will be managed by thoroughly developed CONOPS and early, frequent, interaction with the Fleet customer, to "get it right" prior to Operational Evaluation (OPEVAL). Supporting this effort are state-of-the-art Test and Evaluation facilities at Point Mugu, China Lake, Lakehurst, and Patuxent River used to demonstrate promising Naval Aviation technologies. At these warfare centers, reconfiguration of test aircraft, weapons, and launch and recovery equipment as well as high-fidelity modeling and simulation, allow the Fleet to see a wide array of future capabilities. Restricted-use airspace and weapons ranges support early Fleet experimentation, demonstration, and validation of systems, weapons, and aircraft still under development. Fleet Battle Experiments (FBEs) provide a testing environment for developmental systems.

ONR, DARPA, and Joint service technology and acquisition programs support Sea Trial. Ongoing rapid prototyping and technology-insertion efforts continue through the Advanced Technology Review Board (ATRB), providing a formal means to review capabilities, requirements, and technology approaches.

Impacts of Sea Trial

Because it is Fleet-led, Sea Trial will focus innovation on Warfighter requirements and concerns. It will facilitate access to testing environments where Warfighters can verify doctrine and tactics, and their early involvement will correct deficiencies and manage risk.

NWDC will integrate war gaming, experimentation, and technology to expedite the maturation of new systems via spiral development and rapid prototyping. NWDC will work with OPNAV resource sponsors like N78 to align priorities and secure funding commitments to convert developmental programs, spawned by Sea Trial, into Programs of Record, supported by the Program Objective Memoranda (POM) budget.

Sea Trial is the centerpiece of Navy and Marine Corps experimentation that will fill capabilities gaps and convert new technologies into warfighting instruments.

Research Partnerships

ONR established the FNC program to balance near-term and long-term requirements. Under this process, the Department of the Navy applies approximately half of its S&T budget to over 200 programs that address the Fleet's near-term operational requirements. Aviation Program Managers, acting as transition sponsors, are closely linked to individual FNC programs to ensure the Fleet receives these capabilities quickly. ONR also conducts exploratory and advanced development research in multiple fields, including aeronautics, avionics, air vehicle propulsion, solid and air breathing missile propulsion, gun propulsion, missile and gun projectile guidance and control, warheads, fuse devices (safe and arm), fire control, and targeting.

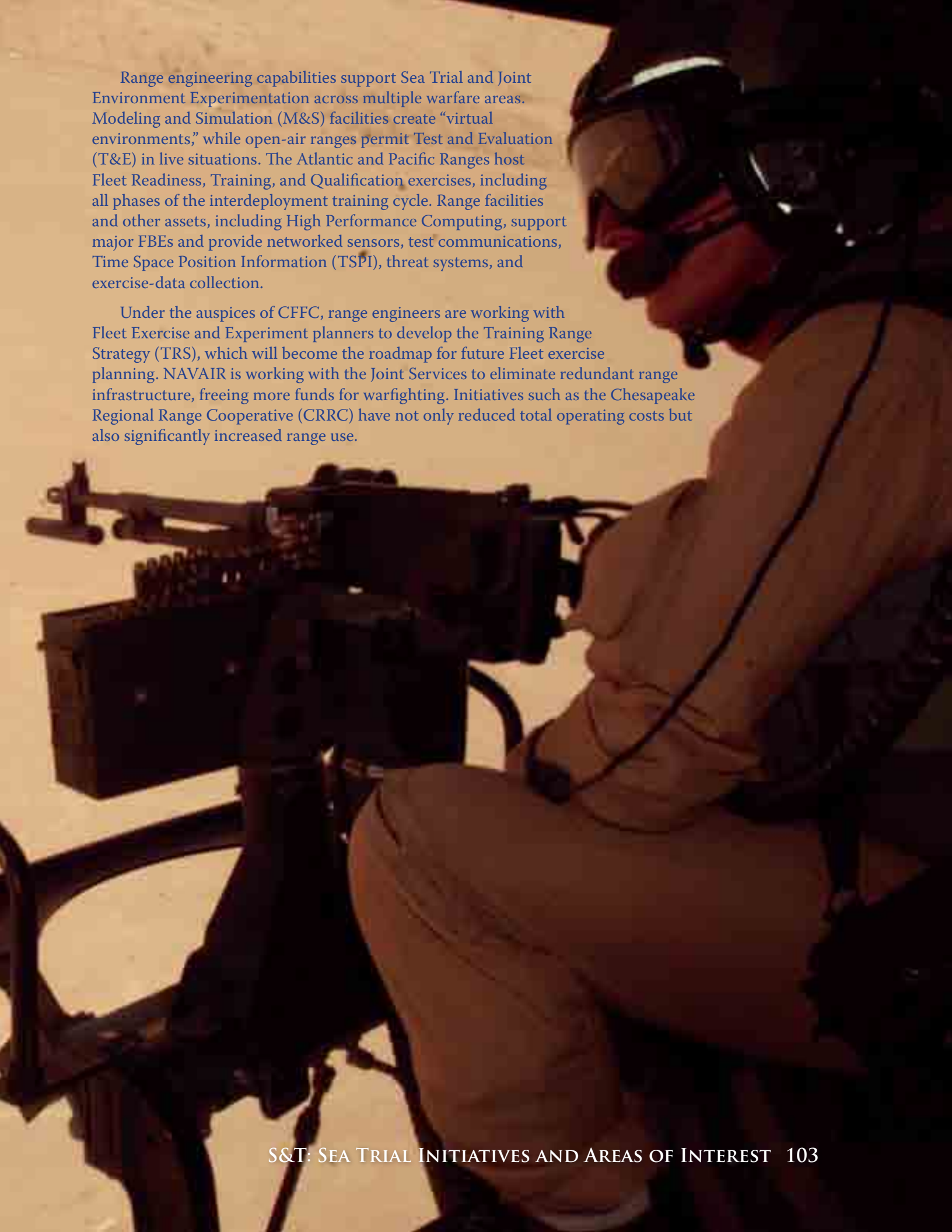
The Advanced Concept Technology Demonstration (ACTD) process, run jointly by DARPA and ONR, allows the Fleet to evaluate advanced technologies that can improve warfighting capability. The Fleet tests the ability of mature technologies to solve immediate problems, and assesses their operational performance. These demonstrations also provide a basis to evaluate and refine operational requirements, develop corresponding CONOPS, and ultimately produce a sound understanding of the application and utility of new technologies. Finally, ACTD processes seek to provide "residual" operational capabilities as an interim solution prior to procurement.

Co-Evolution and Spiral Development

Co-evolution is the simultaneous development of the ways we organize, equip, and fight. Spiral development is the process whereby researchers seek incremental advances that build upon one another to achieve greater results. This facilitates technology insertion, eliminates systemic problems with interoperability, and maintains the focus on improving combat capabilities, creating a closer link between technology development and operational implementation. Spiral development includes the evolution of associated command concepts such as doctrine, TTP, organizational and personnel arrangements, information flow, systems, materiel, education, training, and logistics.

Test Ranges

Test ranges support the Sea Trial concept through test and experimentation. They foster the development and Fleet introduction of advanced Naval Aviation technologies and concepts. Under a unified national command structure, the Atlantic and Pacific RDT&E ranges provide a vision of what is possible, and a single point of entry for training and experimentation.



Range engineering capabilities support Sea Trial and Joint Environment Experimentation across multiple warfare areas. Modeling and Simulation (M&S) facilities create "virtual environments," while open-air ranges permit Test and Evaluation (T&E) in live situations. The Atlantic and Pacific Ranges host Fleet Readiness, Training, and Qualification exercises, including all phases of the interdeployment training cycle. Range facilities and other assets, including High Performance Computing, support major FBEs and provide networked sensors, test communications, Time Space Position Information (TSPI), threat systems, and exercise-data collection.

Under the auspices of CFFC, range engineers are working with Fleet Exercise and Experiment planners to develop the Training Range Strategy (TRS), which will become the roadmap for future Fleet exercise planning. NAVAIR is working with the Joint Services to eliminate redundant range infrastructure, freeing more funds for warfighting. Initiatives such as the Chesapeake Regional Range Cooperative (CRRC) have not only reduced total operating costs but also significantly increased range use.

THE RIGHT FORCE—OUR PEOPLE

"Navy and Marine Corps aviation has no equal in air combat as a result of the professionalism and effectiveness of our most prized capital asset, our people…our Human Capital. Our Human Capital Strategy will enable the creation of a force that provides the right skills, at the right time, to accomplish the right work, in the 21st century."

VADM Jim Zortman, Commander, Naval Air Forces

Introduction

Sea Power 21 is the blueprint for change that will ensure the nation possesses a 21st century Navy to meet 21st century threats. Central to this transformation are our people. Our current and future workforce must be prepared to face a variety of challenges, embrace new missions and meet emerging threats. To do this, we must become a leaner, smarter, and more adaptive force in terms of operational capability and deployment flexibility. Additionally, we need to increase the operational availability of our personnel to exploit the speed, reach, and inherent flexibility of Naval air power. To achieve this transformation, the NAE's Human Capital Strategy (HCS) will provide overarching direction and guidance for the management and development of our people.

What is Human Capital? Simply put, Human Capital is people, and the institutional knowledge they possess that is relevant to the purpose and function of their organization. A Human Capital Strategy will provide the foundation to transform an outdated system of manpower and personnel management and requirements determination into a technologically enhanced system. This strategy must be aligned to the total force (military and civilian). It must be capabilities-based and competency-focused. It must recognize our personnel for performance and it must be agile and adaptive to meet emerging demands.

The Challenge

It is critical to understand why the strategy is necessary, what drives it, and the specific challenges associated with the future environment in which the strategy will operate. A quick assessment of the Navy's existing (default) Human Capital Strategy yields several observations:

- Legacy systems are inflexible and unable to functionally capture our workforce
- Stovepiped organizations create a lack of focus across the Enterprise
- There is no Total Force perspective
- It is uncertain how much we are actually spending
- The return on investment has not been measured
- The budget cycle is driving personnel decisions
- We are deficient in forecasting future skill sets
- We struggle with identifying talent gaps and building critical bench strength
- We have difficulty recruiting and retaining the right people
- There is a distinct lack of meaningful metrics

This default strategy may have been acceptable in the past, but its reactive nature and disjointed approach necessitate the need for a new, Total Force Human Capital Strategy.

The Vision

Our Vision is to create management and personnel development solutions for the 21st century Naval Aviation Enterprise workforce—our Total Force. It begins and ends with readiness and the capability demand signals we receive from the Fleet. Those signals drive the internal products and services we provide; the processes and efficiencies we employ; the mix of skills, talent, and proficiency levels we need; and the recruiting and development strategies we implement as we shape, balance, and size our workforce so that the right people are working on the right things at the right time.

The key elements of the NAE's Human Capital vision are:

- Attract, develop, and retain individuals with the right knowledge, skills, and abilities
- Expand career opportunities
- Shape the force to meet our Total Force requirements
- Capitalize on the operational capabilities delivered by a diverse workforce
- Become a leaner, technology-enabled force
- Become an organization widely recognized as an "employer of choice"

Our strategy will impact the workforce on an individual basis, as we will fundamentally transform the way we attract, manage, grow, develop, and educate our people. It carries with it a promise, one that speaks directly to the personal and professional development of each individual member of our organization. As such, we—the leadership of the NAE—will promise to articulate our expectations, so that everyone understands their role inside our culture of performance and productivity. We will provide our people with the personal and professional tools they need to be successful, and train them with purposeful intent—on time. We will eliminate obsolete policies and organizational structures that inhibit their growth and development, and we will procure and employ new technologies to eliminate unfulfilling work. The work we do will be well-defined, driven by the demands of the Fleet, be of the highest quality and reliability, and resonate with the expectations we have articulated. There will be a direct correlation between the tasking and the talent employed to complete it. Their performance will be measured against well-known, well-defined metrics. Performance will be duly recognized in a timely fashion, and rewards and incentives will be proportional to the effort expended to achieve clearly stated goals and objectives. Through these efforts, we will create opportunities for them to make a difference and challenge them with meaningful and satisfying work.

Executing the NAE's Human Capital Strategy

The roadmap for the NAE's Human Capital Strategy involves several progressive and concurrent steps. First, we are conducting a Human Capital baseline assessment to link our people to the skills required to perform the tasks that support the aircraft and weapon systems necessary to accomplish the NAE's mission. This comprehensive workforce and requirement analysis will tell us *where we are* and frame our Human Capital efforts. Second, we are *projecting our future requirements* so that we shape the workforce correctly to manage not only Sea Power 21 and the FRP, but tomorrow's requirements as well.

With our knowledge of the baseline and our projected future requirements, we will:

- Define the organizational structure and the specific productivity improvements that yield the most *value* and help us change the way we do our work
- *Define the shape of the force* to identify the number and composition of people we need with the right skills to do the work
- Evaluate the operational and business risks associated with the changes we have made and *reassess* whether or not the force is properly shaped
- *Close the gaps* between the skills that presently exist and the performance that is required. We will identify and remove barriers to performance improvement and personal success, and re-train displaced personnel for new opportunities within the NAE.
- Innovate, design, and test *interventions* to close gaps and help us achieve our defined values and force composition
- Fully *implement* change, clearly articulate expectations, roles, and responsibilities, and hold people accountable for achieving the results we expect

Shaping the workforce using equipment and productivity improvements that *change the way we do our work* is fundamental to our Human Capital Strategy. One example of creating efficiency through productivity improvements is the NAE Integrated Maintenance Concept (IMC), which offers force-shaping opportunities by changing the way the work is done. It aligns the interval and content of work packages and links previously disjointed processes that once hampered readiness. Under IMC, the Depot is now treated as a pool of talent from which artisans come to work in the "shadow of the hangar," so Commanding Officers stay in control of their aircraft. Scheduled maintenance at all levels of repair is examined and, if necessary, work is shifted from Sailors to Depot-Level artisans.

Another example is the P-8A MMA contract, which places Human Capital savings up front where they belong. The proposal uses full Contractor Logistics Support (CLS) based on industry's vast commercial aircraft experience, and will employ contractor maintenance worldwide. The P-8A MMA will operate with fewer aviators, maintainers, engineers, and logisticians, due to improved platform capabilities, improved reliability and maintainability, reduced training time, and a commercial maintenance plan for supply and spares. This program exemplifies the NAE's new business model: better capability and higher availability, with fewer aircraft, fewer people, and less cost.

Productivity improvements and new acquisition strategies create opportunities for efficiency resulting in a leaner workforce. Our Human Capital Strategy will also leverage the advantages of productivity improvement tools like Lean, TOC, and Six Sigma to meet the requirements of the FRP and Sea Power 21.

Human Capital Training

The NAE's Training Cross Functional Team has been formed to better focus the delivery of the right number of trained Naval Aviators and support personnel to the Navy and Marine Corps, with the right skills at the right cost.

The NAE's Training Cross Functional Team (CFT): Training from Street-to-Fleet-to-Front

The Training CFT focuses on Naval Aviation training for officers, enlisted personnel, civilians, and contractors. It identifies cost reduction and process improvement opportunities in Naval Aviator, NFO, and aircrew production, maintenance personnel production, and Fleet readiness turnaround training. These processes encompass the continuum of aviation training—from accession, to initial training, to Fleet readiness, and turnaround training. The mission of the Training CFT is to design the most effective and efficient training curriculum, one that emphasizes growth and development, while creating value and generating the cost savings necessary to recapitalize the force. The goals of the Training CFT are to:

- Improve training process management
- Balance output time, cost, and quality
- Train at the right level
- Remain responsive to NAE requirements

Training CFT Organization

The Training CFT is led by CNATRA and composed of three Sub-Teams:

- Naval Aviation Production Team (NAPT) Sub Team: Focuses on Aircrew production processes so that trained Naval Aviators, NFOs, and aircrew meet the needs of our Naval Air Forces
- Sea Warrior Training And Recruiting for Sea Power 21 (STAR21) Sub-Team: Focuses on providing well-trained maintenance personnel to our Naval Air Forces
- Air Warfare Training Continuum: Focuses on Fleet training in preparation for deployment

Air Warfare Training Continuum: The Naval Strike and Air Warfare Center (NSAWC)

As the lead for the Air Warfare Training Continuum, the Naval Strike and Air Warfare Center (NSAWC) at NAS Fallon, NV, is the center of excellence for Navy Aviation training and tactical development. The mission of NSAWC is to improve the warfighting capability of Naval air power, and as such, NSAWC is the primary authority for graduate-level, Navy Aviation tactical development and training. (The NSAWC counterpart for Marine Corps Aviation training is Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) stationed at Marine Corps Air Station (MCAS) Yuma, AZ).

NSAWC was formed in July 1996 through the consolidation of the Naval Strike Warfare Center ("Strike University"), the Naval Fighter Weapons School ("TOPGUN"), and the Carrier Airborne Early Warning Weapons School ("Top Dome"). NSAWC conducts high-fidelity tactical air combat training and assessment for Carrier Air Wings and is responsible for the development, implementation, and administration of several courses of instruction. It is also the point of contact for all issues relating to the Fallon Range Training Complex (FRTC) and provides a large number of services to the Fleet, including:

- Prioritizing research and development initiatives for integrated strike warfare
- Maritime and overland air superiority training
- Strike fighter employment and airborne battle management
- Aviation requirements recommendations
- UAV CONOPS
- CSAR training
- CAS planning and employment

Six Carrier Air Wings per year are cycled through NSAWC training, bringing all the squadrons of an air wing together for approximately four weeks. The course includes scenario strike planning and execution training in a simulated wartime environment. An additional NSAWC course is the Strike Fighter Tactics Instructor (SFTI) syllabus. It entails air-to-air combat training and air-to-ground ordnance delivery over nine weeks, involving extraordinarily detailed study, flight preparation, and in-flight execution. NSAWC pilots fly adversary aircraft to support airborne portions of this training. Each fall, NSAWC hosts a CSAR exercise that includes all branches of the U.S. military.

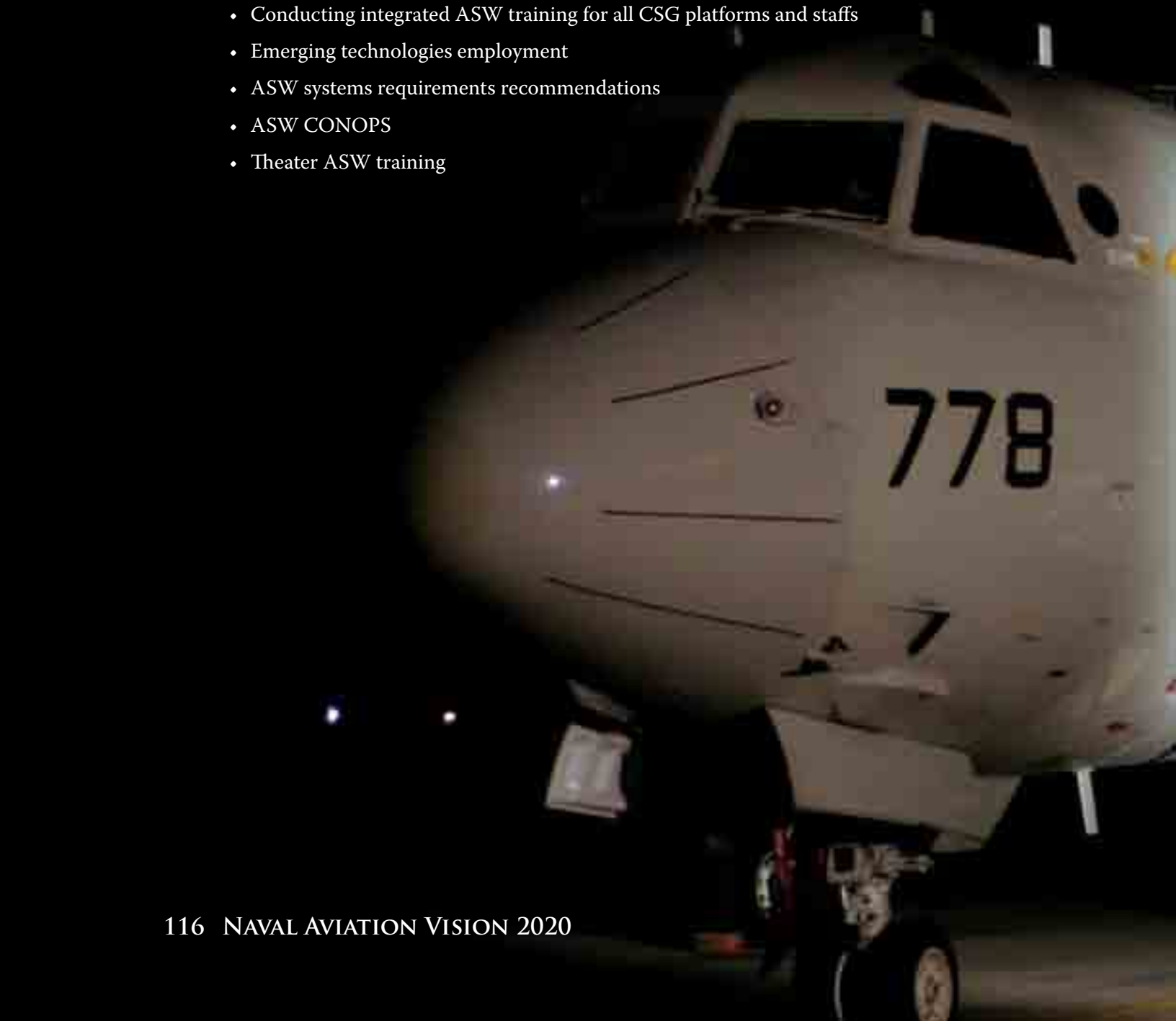
NSAWC's remote location and mild weather combine to offer a superior tactical training environment. Spread over 84,000 acres, large training ranges and electronic warfare sites provide excellent combat realism. For example, the Integrated Air Defense System (IADS) range uses 37 real and simulated radars and has a supersonic flight zone. The FRTC is instrumented with the Tactical Aircrew Combat Training System (TACTS) so that multiple squadrons and aircrews can be trained simultaneously and receive immediate post-mission feedback.

NSAWC operates 15 F/A-18 *Hornets*, 14 F-16 *Vipers* and 4 SH-60 *Seahawks*, and has operational control over Fighter Squadron Composite THIRTEEN (VFC-13), which flies the F-5N *Tiger*. Contract maintenance is provided for all aircraft.

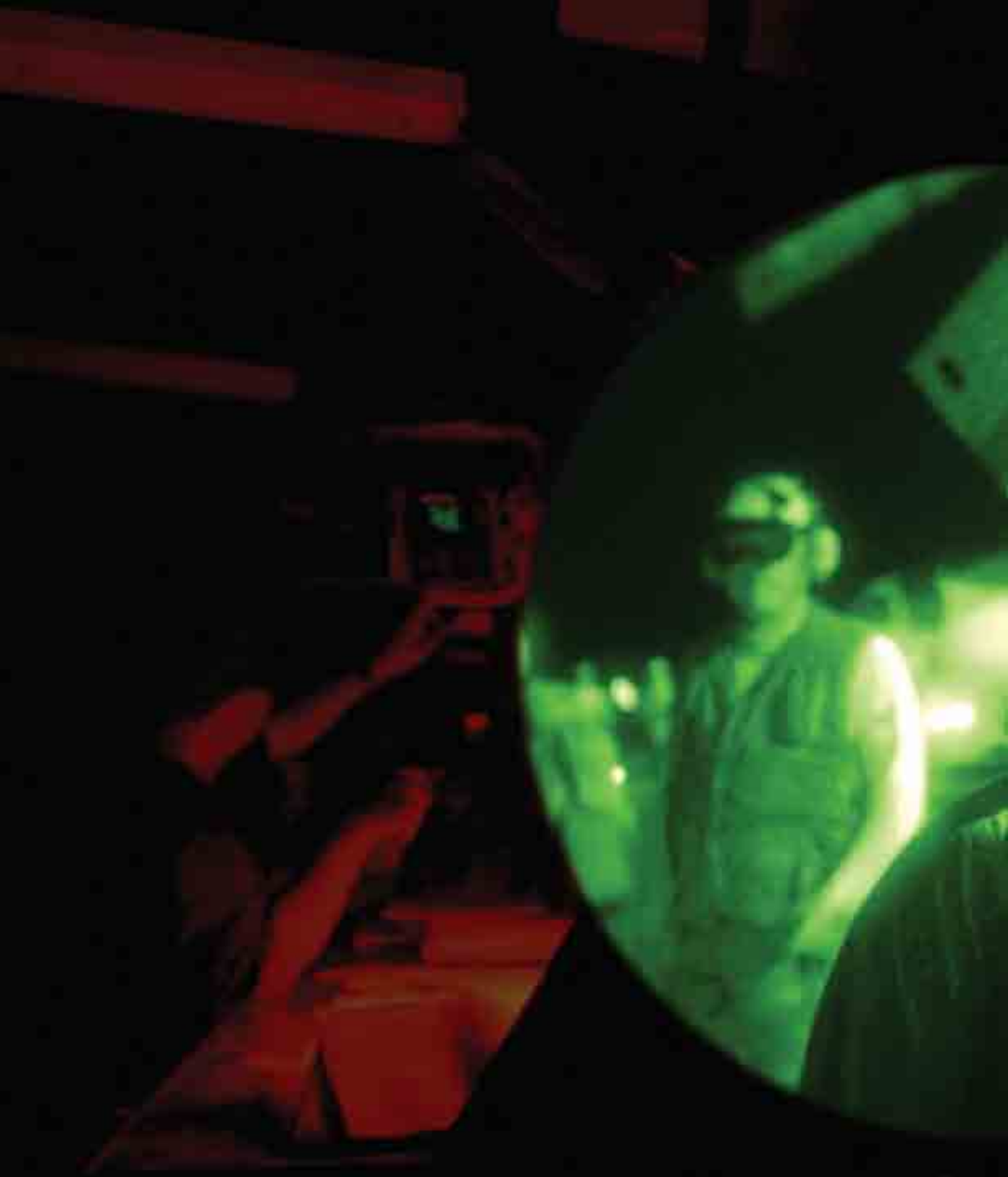
Fleet Anti-Submarine Warfare Command (FLTASWCOM)

Another example of the NAE's focus on Fleet training is the establishment of FLTASWCOM in April 2004, to serve as the center of excellence for Anti-Submarine Warfare. Like NSAWC, the mission of FLTASWCOM is to improve the warfighting capabilities of Naval air power. Additionally, FLTASWCOM trains surface ship and submarine crews, embarked and shore-based staffs, and personnel assigned to Integrated Undersea Surveillance System (IUSS) commands. FLTASWCOM is the primary authority for the Navy's graduate-level, ASW-focused, integrated tactical development and training. It conducts high-fidelity tactical combat training and assessment working with the Commanders of SECOND and THIRD Fleet, and with the Commanders of Strike Force Training Pacific (CSFTP) and Strike Force Training Atlantic (CSFTL). FLTASWCOM is responsible for the development, implementation, and administration of several courses of instruction and is the focal point for all issues relating to the ASW mission area. Headquartered in San Diego, CA, FLTASWCOM maintains detachments in Norfolk, VA, Pearl Harbor, HI, and Yokosuka, Japan. Fleet support includes:

- Prioritizing research and development initiatives to facilitate integrated ASW
- Conducting integrated ASW training for all CSG platforms and staffs
- Emerging technologies employment
- ASW systems requirements recommendations
- ASW CONOPS
- Theater ASW training



FLTASWCOM forms the foundation for integrated tactical ASW training through the Integrated ASW Commander (IAC) course, which is completed by every Destroyer Squadron (DESRON) staff and their subordinate commands, training them on ASW at the CSG level. The course includes scenario mission planning and execution training in a simulated wartime environment. Fleet ASW Command oversees the Maritime Integrated Tailored Training (MITT) exercise and embarks with CSFTP/CSFTL staffs to provide training and assessment support for every CSG Composite Training Unit Exercise (COMPTUEX) and Joint Task Force Exercise (JTFEX). Additionally, FLTASWCOM personnel support theater-level exercises and any ongoing real-world submarine prosecutions.



Naval Air Reserve /Active and Reserve Integration (ARI)

Essential to the NAE's Human Capital Strategy is a vibrant, fully integrated Naval Air Reserve Force that complements our active duty team, and, when necessary, can provide force-level surge capabilities for homeland defense and forward deployments. The outstanding contributions of Naval Reserve Forces to the GWOT have accelerated the effort to more fully integrate Active and Reserve units. The deployment of Reserve Strike Fighter Squadron 201 with *USS THEODORE ROOSEVELT* (CVN-71) during OIF is an example of seamless and effective Active/Reserve Integration (ARI). Also in support of ARI, a new Reserve Force adversary detachment from VFC-13 will stand up in 2006 at NAS Key West, FL, increasing the level of realistic air combat training for active duty squadrons and air wings. Additionally, Naval Air Reservists will continue to fill Naval Aviation flight and ground instruction billets to help meet Naval Aviation's demand for trained Warfighters.

As Reserve units integrate with active duty forces, they will fall under the command of active duty Type Wing Commanders, meaning Reserve assets will now be able to meet active duty augmentation requirements without first being mobilized. Naval Reserve personnel experts assigned to CNAF will manage all Reservists.

The Reserves are a proven source of flexibility—one that offers capability and support at reduced cost, relieves Operations Tempo (OPTEMPO) stress on active duty personnel, and can be mobilized for wartime and contingency operations. The advantages of a robust Naval Reserve force span the breadth of Naval operations, offering the operational and organizational agility required to support the Fleet.

Summary

The goal of the NAE's Human Capital Strategy is to foster the development of a smaller, better-educated, better-trained, and better-compensated workforce. We will not reduce manpower to save money while placing more work on the backs of our Sailors and Marines. Instead, we will use technological advances, create new challenges and opportunities, and change our accession processes to gradually progress toward a leaner force. We will:

- Change how we do the work before we shape the workforce
- Change policies and structures that inhibit the growth and development of our people
- Use technology and AIR*Speed* to eliminate work that is fundamentally unfulfilling or not required
- Assign the right elements of our Total Force to perform the right work

CNATRA and the Training CFT are committed to creating more effective and efficient training processes for Naval Aviation personnel. Improvement initiatives and a balanced approach to training time, cost, and quality produce the best value for Naval Aviation, contribute to the integrity of the Navy and Marine Corps Human Capital Strategy, and strengthen our current and future readiness. The invaluable synergy of Active and Reserve Force Integration will strengthen the ability of the Fleet to deliver the capabilities required to fight the Global War on Terror, to remain persistent, and to secure global access in the maritime domain. Our Human Capital Strategy, focused on the Total Force, will embrace our dedicated and valuable civilian employees as well as those in uniform, so that the right talent, drawn from a diverse corps of professionals, is put to task efficiently and effectively.

Our thinking has progressed, and as our Human Capital Strategy matures, we will no longer make system decisions based solely on capabilities, or allow personnel management to be driven solely by budget restraints. The readiness and capability demand signals received from the Fleet will help define the work that needs to be done, shape our workforce, and positively impact budgeting and programming decisions. The NAE's Human Capital Strategy will be a living management tool—one that is flexible enough to be adjusted when needed, and that is always being assessed, improved, and refined to maintain its relevance.

The business of the Navy and Marine Corps will always be combat, and victory our mission and heritage. Our Human Capital Strategy will preserve this sacred heritage and reflect our belief that Naval Aviation's competitive advantage is, and always will be, its dedicated and superbly talented people.


THE RIGHT COST

The NAE's Cost Management Team (CMT)

The NAE has embarked on a journey to deliver Cost-Wise Readiness, requiring a dramatic shift in our acquisition and spending philosophies. We must become better stewards of our resources because we can no longer afford to deliver readiness at *any* cost, as we have in the past. Our challenge instead is to deliver the *right amount of readiness at the right cost*, so that money can be saved and returned to the Navy and Marine Corps to recapitalize the Fleet. The NAE cannot persevere with a "business as usual" mentality. We must understand what is required to adequately fund Naval Aviation, spend only that, and return the resources we don't need so that they can be used to fund the future.

To help achieve the goal of Cost-Wise Readiness, the NAE construct includes a CMT, chaired by the Chief Financial Officer (CFO) of the NAE (OPNAV N78) and the Director of Fleet Readiness (OPNAV N43). One of the NAE's measures of success is achieving measurable cost savings across the Enterprise and to reinvest those savings to recapitalize the future Navy and Marine Corps. To this end, the NAE's mission, spearheaded by the CMT, is to deliver the maximum product per dollar to Naval Aviation. By developing strategic cost management processes and financial metrics, the CMT will plan and manage the NAE's total cost structure as a holistic enterprise in harmony with NAE goals.

The CMT will perform financial planning and analysis for the NAE, leveraging existing processes and organizational structures to budget, forecast, and manage costs. Their responsibilities include:

- Evaluating the financial soundness of programs and proposals
- Implementing a holistic NAE strategic cost management process and related tools
- Analyzing key cost drivers and excess resources and targeting them for reduction
- Developing a collaborative Enterprise financial planning and analysis organization

These responsibilities will require a strong partnership with existing financial organizations and Enterprise stakeholders who are responsible and accountable for the funds they manage.

SUMMARY

Naval Aviation is first and foremost about warfighting readiness and as such will continue to fulfill the enduring roles of the Navy and Marine Corps. We stand ready to contribute the full measure of our people, power, and technology to combat asymmetric, catastrophic, and disruptive threats and to defend the American homeland. The global security environment demands flexible warfighting strategies, such as FRP, and Naval Aviation will continue to manage its people and resources, providing the presence and unequivocal striking power that our national leadership demands and our country deserves.

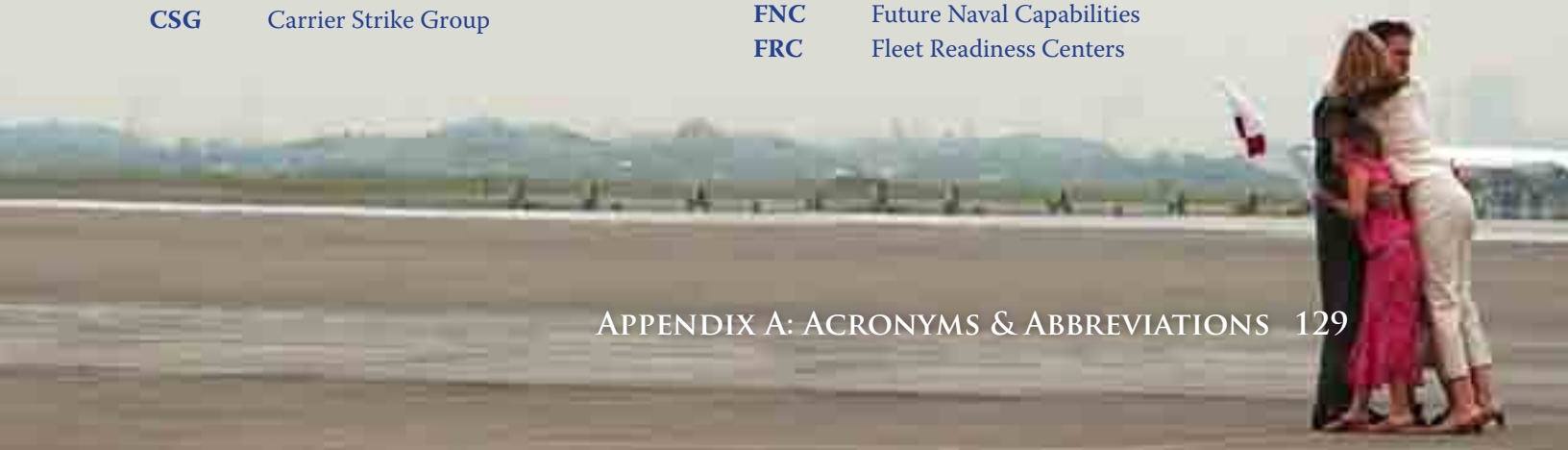
The Naval Aviation Enterprise enables the achievement of a more effective and efficient warfighting force. Its process improvement and productivity initiatives exist to secure the future of Naval Aviation and will transform the way we conduct the business of warfighting, at sea and ashore. The NAE is the end of stovepipe management and the beginning of Enterprise-wide decision-making—a vital step toward realizing our future while maintaining the right level of readiness today.

U.S. Naval Aviation aircraft, weapons systems, and sensors are the best in the world, and they are operated and maintained by the smartest, most industrious, and dedicated people in the world. Our current and future technologies are on course to support the cornerstone strategies of Sea Power 21: FORCEnet, Sea Strike, Sea Shield, Sea Basing, Sea Warrior, Sea Trial, and Sea Enterprise. We will continue to develop new technologies while managing our costs, striking the delicate balance between today's readiness and tomorrow's capabilities, in the Joint environment.

APPENDIX A: ACRONYMS & ABBREVIATIONS

AARGM	Advanced Anti-Radiation Guided Missile
AAW	Anti-Air Warfare
ACE	Aviation Combat Element
ACS	Aerial Common Sensor
ACTD	Advanced Concept Technology Demonstration
ADAR	Air Deployable Active Receiver
AEA	Airborne Electronic Attack
AEER	Advanced Extended Echo Ranging
AEHF	Advanced Extremely High Frequency
AEW	Airborne Early Warning
AFB	Air Force Base
AGMS	Air-to-Ground Missile System
AESA	Active Electronically Scanned Array
AIP	Anti-Surface Warfare Improvement Program
ALFS	Airborne Low Frequency Sonar
ALMDS	Airborne Laser Mine Detection System
AMCM	Airborne Mine Countermeasures
AMP	Avionics Modernization Program
AMRAAM	Advanced Medium-Range Air-to-Air Missile
AMS	Airborne Mine Neutralization System
AMTCS	Aviation Maintenance Training Continuum System
AOR	Area of Responsibility
APKWS	Advanced Precision Kill Weapon System
ARI	Active-Reserve Integration
ARM	Anti-Radiation Missile
ASAT	Anti-SATellite
ASN (RD&A)	Assistant Secretary of the Navy for Research, Development, and Acquisition
ASUW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
ATA	Automatic Target Acquisition
ATDLS	Advanced Tactical Data Link System
ATFLIR	Advanced Targeting Forward-Looking InfraRed
ATRB	Advanced Technical Review Board
AWACS	Airborne Warning And Control System
BAMS	Broad Area Maritime Surveillance
BDA	Battle Damage Assessment
BGPHES	Battle Group Passive Horizon Extension System
BMD	Ballistic Missile Defense
BOD	Board of Directors
BVR	Beyond Visual Range
C^2	Command and Control
C^4I	Command, Control, Communications, Computers, and Intelligence

C⁴ISR	Command, Control, Communications, Computers, and Intelligence, Surveillance and Reconnaissance
CAOC	Combined Air Operations Command
CAS	Close Air Support
CBN	Chemical, Biological, and Nuclear Weapons,
CCG	Computer Control Group
CDL-N	Common Data Link-Navy
CDMR	Compact Deployable Multistatic Receiver
CDMS	Compact Deployable Multistatic Source
CEC	Cooperative Engagement Capability
CEP	Circular Error Probable
CFFC	Commander, Fleet Forces Command
CFO	Chief Financial Officer
CFT	Cross Functional Team
CG	Hull designation for a guided-missile cruiser
CLF	Combat Logistics Force
CLS	Contractor Logistics Support
CMC	Commandant of the Marine Corps
CMT	Cost Management Team
CNAF	Commander, Naval Air Forces
CNAL	Commander, Naval Air Force, U.S. Atlantic Fleet
CNATRA	Chief of Naval Air Training
CNO	Chief of Naval Operations
CNR	Chief of Naval Research
COD	Carrier Onboard Delivery
COMNAVAIRSYSCOM	Commander, Naval Air Systems Command
COMPTUEX	Composite Training Unit Exercise
CONOPS	Concept of Operations
CRRC	Chesapeake Regional Range Cooperative
CSAR	Combat Search And Rescue
CSFTL	Commander, Strike Force Training Atlantic
CSFTP	Commander, Strike Force Training Pacific
CSG	Carrier Strike Group
CSO	Combat Systems Officer
CV	Hull designation for a conventionally-powered aircraft carrier
CVE	Hull designation for a World War II "jeep carrier"
CVIC	Carrier Intelligence Center
CVN	Hull designation for a nuclear-powered aircraft carrier
CVW	Carrier Air Wing
DARPA	Defense Advanced Research Projects Agency
DCGS-N	Distributed Common Ground System-Navy
DCS	Digital Communications System
DEAD	Destruction of Enemy Air Defenses
DESRON	Destroyer Squadron
DEW	Directed Energy Weapon
DII-COE	Defense Information Infrastructure/ Common Operating Environment
DLA	Defense Logistics Agency
DPSS	Digital Precision Strike Suite
EAWS	Enlisted Aviation Warfare Specialty
ECM	Electronic CounterMeasures
ECCM	Electronic Counter-CounterMeasures
EMALS	Electro-Magnetic Aircraft Launch System
EO	Electro-Optical
EO/IR	Electro-Optical/InfraRed
EOB	Enemy Order of Battle
ESG	Expeditionary Strike Group
ESM	Electronic Support Measures
EW	Electronic Warfare
FARP	Forward Arming and Refueling Point
FBE	Fleet Battle Experiment
FFG	Hull designation for a guided-missile fast frigate
FLIR	Forward-Looking InfraRed
FLTASWCOM	Fleet Anti-Submarine Warfare Command
FNC	Future Naval Capabilities
FRC	Fleet Readiness Centers



FRP	Fleet Response Plan
FRTC	Fallon Range Training Complex
FTI	Fast Tactical Imagery
FY	Fiscal Year
GIG	Global Information Grid
GIG-ES	Global Information Grid-Enterprise Services
GP	General Purpose
GPS	Global Positioning System
GWOT	Global War on Terror
HARM	High Speed Anti-Radiation Missile
HCS	Human Capital Strategy
HDBT	Hard and Deeply Buried Target
HEL	High Energy Laser
HLR	Heavy Lift Replacement
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HQMC	Headquarters Marine Corps
HPM	High-Power Microwave
HS/H	High Speed/Hypersonic
HSI	Human Systems Integration
HSW	High Speed Weapon
IAC	Integrated ASW Commander Course
IADS	Integrated Air Defense System
ICAP III	Improved Capability III
ICBM	Inter-Continental Ballistic Missile
IIR	Imagery InfraRed
IMC	Integrated Maintenance Concept
IMINT	Imagery Intelligence
INS	Inertial Navigation System
IO	Information Operations
IOC	Initial Operational Capability
IP	Internet Protocol
IPT	Integrated Product Team
IR	InfraRed
ISR	Intelligence, Surveillance, and Reconnaissance
ISRT	Intelligence, Surveillance, Reconnaissance, and Targeting
IUSS	Integrated Undersea Surveillance System
JAN-TE	Joint Airborne Network-Tactical Edge
JDAM	Joint Direct Attack Munition
JETI	Jet Engine Test Instrumentation
JFN	Joint Fires Network
JHMCS	Joint Helmut Mounted Cueing System
JMOD	Joint Signals Intelligence Avionics Family (JSAF) Block Modernization Program
JMPS	Joint Mission Planning System
JSF	Joint Strike Fighter
JSIPS-N	Joint Sensor Image Processing System-Navy
JSOW	Joint Standoff Weapon
JTF	Joint Task Force
JTFEX	Joint Task Force Exercise
JTRS	Joint Tactical Radio System
J-UCAS	Joint-Unmanned Combat Air System
LSO	Landing Signal Officer
LCAC	Landing Craft, Air Cushioned
LCS	Littoral Combat Ship
LGB	Laser-Guided Bomb
LHA	Hull designation for an amphibious assault ships
LHA(R)	LHA Replacement
LTA	Lighter Than Air
M&S	Modeling and Simulation

MARCENT Marine Forces Central Command
M/BVR Medium/Beyond Visual Range
MAC Metal Augmented Charge
MAGTF Marine Air Ground Task Force
MANPADS MAN-Portable Air Defense Systems
MASINT Measurements and Signatures Intelligence
MAW Marine Aircraft Wing
MAWTS Marine Aviation Weapons and Tactics Squadron
MCAS Marine Corps Air Station
MCM Mine Countermeasures
MEU Marine Expeditionary Unit
MIDS Multi-functional Information Distribution System
MIDS-JTRS MIDS-Joint Tactical Radio System
MIDS-LVT MIDS-Low Volume Terminal
MITL Man-In-The-Loop
MITT Maritime Integrated Tailored Training
MIW Mine Interdiction Warfare
MMA Multi-Mission Maritime Aircraft
MPA Maritime Patrol Aircraft
MPF Maritime Pre-Positioning Force
NAE Naval Aviation Enterprise
NAE BOD NAE Board of Directors
NAI National Aerospace Initiative
NAPT Naval Aviation Production Team
NAS Naval Air Station
NAVAIR Naval Air Systems Command
NAVICP Naval Inventory Control Point
NAVRIIP Naval Aviation Readiness Integrated Improvement Program
NAVSEA Naval Sea Systems Command
NAVSUP Naval Supply Systems Command
NCDP Naval Capability Development Process
NETC Naval Education and Training Command
NETWARCOM Naval Network Warfare Command
N-PFPS Navy-Portable Flight Planning Software
NSAWC Naval Strike and Air Warfare Center
NSW Naval Special Warfare
NUFEA Navy Unique Fleet Essential Airlift
NWDC Navy Warfare Development Command
OAMCM Organic Airborne Mine CounterMeasures
OASIS Organic Airborne and Surface Influence System
OEF Operation Enduring Freedom
OFP Operational Flight Program
OIF Operation Iraqi Freedom
OMFTS Operational Maneuver From The Sea
ONR Office of Naval Research
OPAREA Operational Area
OPEVAL Operational Evaluation
OPNAV Office of the Chief of Naval Operations
OPTEMPO Operations Tempo
OTH Over-The-Horizon
P³I Pre-Planned Product Improvement
PAA Primary Aircraft Authorized
PEO Program Executive Office
PMA Program Manager Air
POM Program Objective Memoranda
PPBE Programming, Planning, and Budgeting Environment
RAMICS Rapid Airborne MIne Clearance System
RAMP Required Avionics Modernization Program
RDT&E Research, Development, Test, and Evaluation
RF Radio Frequency
RFI Ready For Issue
RFT Ready For Tasking

RIMPAC RIM of the PACific
RMP Radar Modernization Program
S&T Science and Technology
SA Situational Awareness
SAR Synthetic Aperture Radar
SAR Search And Rescue
SATCOM Satellite Communication
SEAD Suppression of Enemy Air Defenses
SFTI Strike Fighter Tactics Instructor
SHARP SHAred Reconnaissance Pod
SIAP Single Integrated Air Picture
SIGINT Signals Intelligence
SIPRnet Secret Internet PRotocol network
SLAM-ER Standoff Land Attack Missile-Expanded Response
SLOC Sea Lines of Communication
SN Seaman
SOF Special Operations Forces
SPAWAR Space and Naval Warfare Systems Command
SRT Synthetic Radar Training
SSIP Sensor System Improvement Program
SSN Hull designation for an attack submarine
STAR21 Sea Warrior Training And Recruiting for Sea Power 21
STOL Short TakeOff and Landing
STOM Ship-to-Objective Maneuver
STOVL Short TakeOff/Vertical Landing
SUW Surface Warfare
SYSCOM Systems Command
T&E Testing and Evaluation
TACAIR Tactical Air
TACTS Tactical Aircrew Combat Training System
TAMD Theater Air and Missile Defense
TAMPS Tactical Automated Mission Planning System
TARPS Tactical Airborne Reconnaissance Pod System

TBMD/CMD Theater Ballistic Missile Defense /Cruise Missile Defense
TCS Tactical Control System
TCT Time Critical Targeting
TDM Tactical Dissemination Module
TLAM Tomahawk Land Attack Missile
T/M/S Type/Model/Series
TOC Theory of Constraints
TOW Tube-Launched, Optically-Tracked, Wire-Guided Missile System
TRS Training Range Strategy
TSPI Time Space Position Information
TSS Time Sensitive Strike
TTP Tactics, Techniques, and Procedures
TYCOM Type Commander
UAV Unmanned Aerial Vehicle
UCAV Unmanned Combat Air Vehicle
USAF United States Air Force
USMC United States Marine Corps
USN United States Navy
USSTRATCOM U.S. Strategic Command
VAATE Versatile Affordable Advanced Turbine Engine
VERTREP Vertical Replenishment
VLF Very Low Frequency
VOD Vertical Onboard Delivery
VS Virtual SYSCOM
V/STOL Vertical/Short TakeOff and Landing
VTOL Vertical TakeOff and Landing
VTUAV Vertical Takeoff and Landing Tactical UAV
VUAV Vertical Takeoff and Landing UAV
WIA Weapon Impact Assessment
WIP Work-In-Progress
WMD Weapon of Mass Destruction
WRC Warfighter Response Center

APPENDIX B: IMAGE CREDITS

Original 3D models of aircraft, *CVN 21*-class, and weapons provided by:
Bell Helicopter, Boeing, Lockheed Martin, Northrop Grumman, Raytheon, and Sikorsky.

Model enhancements by Chris Jantsch.

iii Atlantic Ocean (18 Jul 04) – *USS HARRY S. TRUMAN* (CVN-75) participates in exercise Majestic Eagle off the coast of Morocco. (U.S. Navy photo by PHAN Ryan O'Connor, USN; conceptual images by Ken Collins)

iv Pacific Ocean (25 Jun 04) – An F/A-18E *Super Hornet* piloted by CAPT Scott Swift, USN, Commander, Carrier Air Wing Fourteen (CVW-14), launches from the deck of *USS JOHN C. STENNIS* (CVN-74). This was CAG Swift's final flight as Air Wing Commander, courtesy of the VFA-115 "Eagles."
(U.S. Navy photo by PH2 Jayme Pastoric, USN)

vii (2004) – An AV-8B *Harrier* from the "Flying Nightmares" of VMA-513 (Detachment A), launched from *USS PELELIU* (LHA-5), receives fuel from a VFA-41 "Black Aces" F/A-18F *Super Hornet.*
(U.S. Marine Corps photo by Major John A. "Bull" Rahe, USMC)

viii–ix Island of Sumatra, Indonesia (12 Jan 05) – An MH-60S *Knighthawk* helicopter, assigned to the "Gunbearers" of HC-11 (Detachment Two), idles on a provincial road outside Banda Aceh while aircrew pass out relief supplies after Southeast Asia's devastating tsunami. (U.S. Navy photo by PH3 M. Jeremie Yoder, USN)

1 Composite photo created by Ken Collins:

Island of Sumatra, Indonesia (10 Jan 05) – Landing Craft, Air Cushioned (LCAC) vehicles attached to *USS BONHOMME RICHARD* (LHD-6) and Expeditionary Strike Group FIVE (ESG-5) deliver supplies to the people of Meulobah.
(DoD photo by PH1 Bart A. Bauer, USN)

Everett Naval Base, Washington (4 Mar 05) – The national ensign flies from the stern of *USS ABRAHAM LINCOLN* (CVN-72) upon its return from a surge deployment to the Western Pacific Ocean. *LINCOLN* and Carrier Air Wing TWO contributed over 5 million pounds of supplies to the island of Sumatra, Indonesia as part of Operation Unified Assistance. (U.S. Navy photo by PH3 James R. McGury, USN)

In the skies over Iraq, a KC-10 from the 908th Expeditionary Air Refueling Squadron refuels two F/A-18 *Hornets* from the "Rampagers" of VFA-83, during OIF.
(U.S. Air Force photo by TSgt Erik Gudmundson, USAF)

(26 Feb 04) Expeditionary Strike Group Two (ESG-2), comprised of *USS WASP* (LHD-1) with the 22nd Marine Expeditionary Unit (MEU) embarked, *USS LEYTE GULF* (CG-55), *USS YORKTOWN* (CG-48), *USS SHREVEPORT* (LPD-12), *USS WHIDBEY ISLAND* (LSD- 41), *USS MCFAUL* (DDG -4), and *USS CONNECTICUT* (SSN-22) deploy in support of the Global War on Terror (GWOT).
(USN photo by PH3 David K. Simmons, USN)

Arabian Gulf (17 Nov 04) – An aircraft director stands ready to receive an F-14 *Tomcat* on catapult #3 of the *USS JOHN F. KENNEDY* (CV-67). The *KENNEDY* Carrier Strike Group was supporting ground troops in Fallujah, Iraq during Operation Al Fajr (New Dawn). (U.S. Navy photo by PH2 (NAO/SW/AW) Michael Sandberg, USN)

2–3 Persian Gulf (15 Jan 05) – *USNS SATURN* (T-AFS 10) conducts Vertical Replenishment (VERTREP) with *USS HARRY S. TRUMAN* (CVN-75) and *USS MONTEREY* (CG-61) assigned to Carrier Strike Group TEN (CSG-10), deployed in support of the GWOT. (U.S. Navy photo by PH1 Richard J. Brunson, USN)

5 Indian Ocean (24 Sep 04) – Inside the Intelligence Center on board *USS JOHN C. STENNIS* (CVN-74), IS2 Damon Jenkins, USN, reviews reconnaissance imagery provided by the "Tomcatters" of VF-31, photographed during their final TARPS mission. (U.S. Navy photo by PH3 Mark J. Rebilas, USN)

6–7 (27 Nov 04) – The Honorable Gordon R. England, Secretary of the Navy, talks to Marines from the "Red Dragons" of HMM-268 during a visit to Camp Taqaddum, Iraq. (U.S. Marine Corps photo by SSgt Jim Goodwin, USMC)

8–9 Top right: The "Philippine Mars" Martin JRM-1 patrol bomber. Bottom right: A *K*-class non-rigid airship. Bottom: A CVE "jeep carrier." (U.S. Navy photos from the Patuxent River Naval Aviation Museum archives)

10–11 (27 Jan 03) – An AV-8B *Harrier* launches from the *USS BONHOMME RICHARD* (LHD-6), part of the seven-ship Amphibious Task Force West (ATF-W) deployed in support of OEF. (U.S. Navy photo by PH2 Jennifer Swader, USN)

12–13 Pacific Ocean (21 Oct 04) – An HH-60H *Seahawk*, assigned to the "Black Knights" of HS-4, conducts a simulated Search And Rescue (SAR) mission alongside *USS JOHN C. STENNIS* (CVN-74), on its way home from a forward deployment with CVW-14. (U.S. Navy photo by PH3 Mark J. Rebilas, USN)

14–15 (10 Oct 02) In support of OEF, U.S. Army Special Forces and U.S. Navy SEALs parachute from an MH-53E *Sea Dragon* helicopter assigned to the "Vanguards" of HM-14. (U.S. Navy photo by PH2 (SW) Michael Sandberg, USN)

16–17 Western Pacific Ocean (7 Aug 04) – Sailors observe a rendezvous between the *USS KITTY HAWK* (CV-63) and *USS JOHN C. STENNIS* (CVN-74) Carrier Strike Groups during Summer Pulse 2004. (U.S. Navy photo by PHAN Bo J. Flannigan, USN)

18–19 (26 Jan 05) – LT David Dequeljoe, USN, a Landing Signal Officer (LSO) assigned to the "Swordsmen" of VF-32, watches the approach of a VS-22 "Checkmate" S-3B *Viking*, recovering on board *USS HARRY S. TRUMAN* (CVN-75). (U.S. Navy photo by PHAN Kristopher Wilson, USN)

PHAN Philip V. Morrill, USN

20–21 (27 Jan 05) – An F/A-18A+ *Hornet* assigned to the "Silver Eagles" of VMFA-115 on the flight deck of *USS HARRY S. TRUMAN* (CVN-75). (U.S. Navy photo by PHAN Philip V. Morrill, USN)

22–23 Hangar 109, NAS Patuxent River, MD (10 Dec 04) – Home of the H-1 helicopter upgrade program and V-22 *Osprey*. (U.S. Navy photo by Chris Jantsch)

25 Arabian Sea (6 Oct 02) – Conceptual image of the E2-D *Advanced Hawkeye* inspired by an E-2C *Hawkeye* taking off from *USS ABRAHAM LINCOLN* (CVN- 72), deployed in support of OEF. (U.S. Navy photo by PH2 Aaron Ansarov, USN; E-2D *Advanced Hawkeye* conceptual image provided by Ken Collins)

26–27 Persian Gulf (22 Dec 04) – Airman Silvia Rodriguez, USN, a Plane Captain assigned to the "Zappers" of VAQ-130, performs a pre-flight inspection of an EA-6B *Prowler* prior to flight operations on board *USS HARRY S. TRUMAN* (CVN- 75). *TRUMAN* and CVW-3 deployed in support of the GWOT. (U.S. Navy photo by PH2 Danny Ewing, Jr., USN)

29 NAS Oceana, VA (25 Sep 04) – An F/A-18F *Super Hornet* from the "Flying Eagles" of VFA-122 performs a "high-g maneuver" at the NAS Oceana Air Show. (U.S. Navy photo by PH2 Daniel J. McLain, USN)

31 Kuwait (16 Mar 03) – Members of Underwater Construction Team Two (UCT-2) prepare for explosive training. (U.S. Navy photo by PH1 (SW) Aaron Ansarov, USN; MV-22 *Osprey* conceptual image provided by Chris Jantsch)

32 U.S. Navy photo by PH2 Eric S. Logsdon, USN; MV-22 *Osprey* conceptual image provided by Ken Collins

34–35 Arabian Gulf (15 Apr 03) – An F/A-18 *Hornet* (digitally altered to represent an F-35C *Joint Strike Fighter)* from the "Mighty Shrikes" of VFA-94, leaves a contrail while flying in support of OIF. (U.S. Navy photo; F-35C *JSF* conceptual image by Ken Collins)

36 Pacific Ocean (16 Nov 04) – *USS NIMITZ* (CVN-68) underway off the southern California coast. (U.S. Navy photo by PH3 Elizabeth Thompson, USN)

38–39 Plan view of the *CVN 21*-class aircraft carrier. (Provided by Chris Jantsch)

40 Elmendorf AFB, AK (19 Jul 04) – An F/A-18 *Super Hornet* from the "Black Aces" of VFA-41 soars through the sky during a training mission for Cooperative Cope Thunder, the largest multi-lateral air combat training exercise in the Pacific. (U.S. Air Force photo by SSgt Ricky A. Bloom, USAF)

PH1 (AW) Bart A. Bauer, USN

PH2 Eric S. Logsdon, USN

42–43 Fallujah, Iraq (9 Nov 04) -- Operation Al Fajr (New Dawn), involving the 1st Marine Division, eradicates enemy forces in the city of Fallujah, as part of security and stabilization operations in the Al Anbar province. (U.S. Marine Corps photo by LCpl Joel A. Chaverri, USMC; "J-UCAS strike" conceptual image by Ken Collins)

44 Yuma, Arizona (2004) - An AH-1Z *Super Cobra* releases flares during weapons testing over Yuma Proving Grounds.
(Photo by Yuma Proving Grounds Imaging Department)

46–47 NAS Patuxent River, MD (10 Dec 04) – An E-6B *Mercury* from the VQ-4 "Shadows" takes off from NAS Pax River. (U.S. Navy photo by Chris Jantsch)

48–49 NAS Patuxent River, MD (2 Dec 03) – An SH-3 *Sea King* carrying the Chief of Naval Operations arrives at NAS Pax River. (U.S. Navy photo)

50–51 Kandahar, Afghanistan (30 Oct 04) – P-3C *Orion* aircraft of the VP-9 "Golden Eagles." (U.S. Navy photo by LCDR David M. Scott, USN)

53 NAS Patuxent River, MD (30 Mar 05) – An MH-60R *Seahawk* helicopter from the "Pioneers" of Air Test and Evaluation Squadron ONE (VX-1), hovers above the Chesapeake Bay. (U.S. Navy photo by Chris Jantsch)

54–55 (29 Mar 03) – *USNS MOUNT BAKER* (T-AE 34) conducts VERTREP alongside *USS HARRY S. TRUMAN* (CVN-75) during a six-month deployment in support of OIF. (U.S. Navy 15-shot photo layout by PH3 (AW/SW/NAC) Christopher B. Stoltz, USN)

56 (28 Oct 02) – The sixth C-40A *Clipper* is delivered to the U.S. Naval Reserves in Wichita, KS. It was later assigned to VR-58 in Jacksonville, FL.
(Photo provided by The Boeing Company)

58–59 NAS Patuxent River, MD (3 Dec 03) – A VC-20D *Gulfstream IV* aircraft on approach to NAS Pax River. (U.S. Navy photo by Chris Jantsch)

60–61 NAS North Island, CA (9 Nov 02) – A C-130T *Hercules* Logistics Support Aircraft from the VR-54 "Revelers" taxis to the runway. (U.S. Navy photo by Chris Jantsch)

62–63 Southern California (5 May 04) – A section of E-2C *Hawkeyes* from the "Black Eagles" of VAW-113 and the "Sun Kings" of VAW-116, flies off the coast of Southern California. (U.S. Navy photo by JO2 Thomas Peterson, USN; E2-D *Advanced Hawkeye* conceptual image by Ken Collins)

64–65 FORCEnet illustration by Ken Collins, Chris Jantsch, and Greg Makrakis.

68–69 Central Iraq – The wideband satellite and UHF antenna farm of the 123rd Signal Battalion, 3rd Infantry Division. (U.S. Army photo by SGT Igor Paustovski, USA)

70 NAS Patuxent River, MD (1 Oct 04) – A T-6A *Texan II* from Training Air Wing Six "holds short," waiting for takeoff clearance. (U.S. Navy photo by Chris Jantsch)

72–73 Mediterranean Sea (30 Mar 03) – Aviation Ordnancemen move Laser-Guided Bombs (LGBs) from an elevator on board *USS THEODORE ROOSEVELT* (CVN-71). *ROOSEVELT* and CVW-8 were conducting missions in support of OIF.
(U.S. Navy photo by PHAR Chris Thamann, USN; image composite by Chris Jantsch)

74–75 Fallujah, Iraq – A precision air strike destroys an insurgent stronghold, helping 3rd Battalion, 1st Marines, 1st Marine Division move through the city of Fallujah during Operation Al Fajr (New Dawn).
(U.S. Marine Corps photo by LCpl Thomas D. Hudzinski, USMC)

76–77 Central Command AOR – An F/A-18C *Hornet* assigned to the "Gunslingers" of VFA-105, during OIF. (U.S. Navy photo by CDR Tom "Walli" Lalor, USN)

78–79 Persian Gulf (3 Dec 04) – An E-2C *Hawkeye* assigned to the *Seahawks* of VAW-126 launches from the flight deck of *USS HARRY S. TRUMAN* (CVN-75). *TRUMAN* and CVW-3 conducted ISR and CAS missions over Iraq.
(U.S. Navy photo by PHAA Ricardo J. Reyes, USN)

80–81 Tallil Air Base, Iraq (7 May 03) – Lance Corporal John Ideus, USMC from Marine Wing Support Squadron (MWSS)-371 stands by to ground and fuel an AH-1 *Cobra* helicopter at a Forward Area and Refueling Point (FARP) during OIF.
(U.S. Air Force photo by SSgt Shane A. Cuomo, USAF)

82–83 Indian Ocean (20 Sep 04) – CDR George Slook, USN, Executive Officer of the VFA-113 "Stingers," launches an AIM-9 *Sidewinder* missile from an F/A-18 *Hornet* during an underway missile exercise. VFA-113 is assigned to CVW-14, embarked on *USS JOHN C. STENNIS* (CVN-74). (U.S. Navy photo by PH3 Mark J. Rebilas, USN)

84–85 (10 Nov 02) – An MD-3 tow tractor moves a VFA-14 F/A-18E *Super Hornet*. The "Tophatters" are embarked on board *USS NIMITZ* (CVN-68).
(U.S. Navy photo by Chris Jantsch)

86–87 San Diego, CA (14 Aug 02) – On the fantail of *USS NIMITZ* (CVN-68), an F404 engine used to power the F/A-18 *Hornet* is taken to full afterburner using the new Jet Engine Test Instrumentation (JETI) system.
(U.S. Navy photo by PHAN Sara Bohannan, USN)

88–89 Al Asad, Iraq (17 Dec 04) – Two CH-53 *Sea Stallion* medium lift helicopters return from conducting a weapons shoot during the visit of LtGen Wallace C. Gregson, USMC, Commander, U.S. Marine Forces Central Command (MARCENT).
(U.S. Marine Corps photo by Cpl Jessica L. Richards, USMC)

90–91 Pacific Ocean (28 Jun 04) – *USS TARAWA* (LHA-1) approaches Pearl Harbor, HI to participate in exercise RIMPAC 2004.
(U.S. Navy photo by PH2 Richard J. Brunson, USN)

92–93 Photo of the Himalayan Mountain range taken from the space shuttle *Columbia*.
(J-UCAS image composition by Ken Collins)

94–95 Mediterranean Sea (4 Jan 05) – LTJG Brooke O'Brien, USN, copilots a P-3C *Orion* assigned to the "Mad Foxes" of VP-5, during a scheduled deployment in support of the GWOT. (U.S. Navy photo by PH3 Jesse L. Paquin, USN)

96–97 Arabian Gulf – The "Blackhawks" of HM-15 retrieve the AN/AQS-14A Side-Looking Sonar used to detect underwater mines and analyze mine warfare data.
(U.S. Navy photo by PH2 Christopher Mobley, USN)

98–99 U.S. Navy photo by Randy Hepp.

100–101 NAS Patuxent River, MD (4 Aug 04) – A pair of MV-22 *Ospreys* on the ramp at NAS Pax River. (U.S. Navy photo by Chris Jantsch; image composition by Ken Collins)

102–103 Near Camp Taqaddum, Iraq (25 May 04) – SSgt Mark J. Covill, USMC, attached to the "Coyotes" of HMLA-775, surveys the area around a farm from his UH-1N *Huey* helicopter. (U.S. Marine Corps photo by LCpl Samuel Bard Valliere, USMC)

105 Atlantic Ocean (29 Sep 03) – An Aviation Boatswain's Mate, enveloped by steam from the catapults of *USS RONALD REAGAN* (CVN-76), signals for an aircraft to taxi into position during CVW-17 carrier qualifications.
(U.S. Navy photo by PH2 Chad McNeeley, USN)

106–107 South China Sea (31 Aug 04) – Aviation Ordnancemen carefully guide a skid loaded with ammunition through the hangar bay of *USS JOHN C. STENNIS* (CVN-74).
(U.S. Navy photo by PH3 Mark J. Rebilas, USN)

PH3 Craig R. Spiering, USN

109 Arabian Sea – Sailors from the Air Department of *USS ABRAHAM LINCOLN* (CVN-72) pose for an advertising campaign concept, entitled "Check out our new fall colors." Pictured are: AN Mardi Ros (blue shirt), ABHAN Lavar Jones (red shirt), ABE2 Michelle Brown (green shirt), ABH3 (EAWS) Shawn Riley (purple shirt), and AN George Pena (yellow shirt). (U.S. Navy photo and layout concept by PH2 Aaron Ansarov, USN, and PH3 Jennifer Nichols, USN)

110 Persian Gulf (11 Jan 05) – LT James Keating, USN, gives a thumbs-up to a catapult operator from the flight deck of *USS HARRY S. TRUMAN* (CVN-75). (U.S. Navy photo by PH3 Craig R. Spiering, USN)

112–113 MCAS Miramar, CA (24 Sep 04) – An MV-22 *Osprey* from VMX-22, stationed at MCAS New River, NC, approaches MCAS Miramar, CA. (U.S. Marine Corps photo by Sgt J.L. Zimmer III, USMC)

114–115 NAS Key West, FL (7 Jan 05) – Pilots assigned to the "Saints" of VFC-13, preflight their F-5E/F *Tiger* adversary aircraft. (U.S. Navy photo by JO1 Trice Denny, USN).

116–117 Sigonella, Sicily (12 Jan 05) – A maintenance crew changes the number two engine propeller of a P-3C *Orion* attached to the VP-5 "Mad Foxes," deployed to NAS Sigonella. (U.S. Navy photo by PH3 Jesse L. Paquin, USN)

118–119 Arabian Sea – An aircrewman from the HS-4 "Black Knights" walks to his aircraft in preparation for a night training mission, launching from *USS ABRAHAM LINCOLN* (CVN-72). (U.S. Navy photo by PH2 Aaron Ansarov, USN)

120–121 Dam Neck, VA (5 Dec 02) – SN Vanessa Rutter, USN, a student at the Navy and Marine Corps Intelligence Training Center (NMITC). (U.S. Navy photo by PHC Chris Desmond, USN)

122 (2004) – Major John A. "Bull" Rahe, USMC, launches from *USS PELELIU* (LHA-5) in a VMA-513 "Flying Nightmares" AV-8B *Harrier.* (U.S. Marine Corps photo by VMA-513)

124 Yokosuka, Japan (2 Nov 04) – AW2 Jimmy Robinson, USN, assigned to the "Chargers" of HS-14, scans the horizon during a routine training flight over Tokyo Bay. HS-14 is part of CVW-5, embarked in *USS KITTY HAWK* (CV-63). (U.S. Navy photo by PH2 William H. Ramsey, USN)

126–127 North Atlantic Ocean (12 Jul 04) – *USS HARRY S. TRUMAN* (CVN-75) participates in Majestic Eagle, a multi-national exercise involving U.S., allied, and coalition naval forces. (U.S. Navy photo by PHAN Ryan O'Connor, USN)

PH2 (AW) Richard J. Brunson, USN

128–129 (22 May 04) – A pilot from the "Diamondbacks" of VFA-102 greets his family upon returning from a three-month deployment with CVW-5, embarked in *USS KITTY HAWK* (CV-63). (U.S. Navy photo by PH1(SW) Aaron Ansarov, USN)

130 U.S. Navy photo by PH2 Eric S. Logsdon, USN; image editing by Ken Collins

132-133 Fallujah, Iraq (15 Nov 04) – A CH-53E *Super Stallion* helicopter from the "Flying Tigers" of HMH-361, rests among rocky terrain near border Fort Number 21 in support of Operation Al Fajr (New Dawn). (U.S. Marine Corps photo by Cpl Christopher R. Rye, USMC; MV-22 conceptual image by Ken Collins.)

135 PHAN Philip V. Morrill, USN, visualizes a "shot" on board *USS HARRY S. TRUMAN* (CVN-75). (U.S. Navy photo by PHAN Ricardo J. Reyes, USN)

136 Meulobah, Indonesia – PH1 (AW) Bart A. Bauer, USN, photographs Cpl Anthony Gray, USMC, a Marine Corps radio operator, during tsunami relief operations in Southeast Asia. (U.S. Navy photo by PHC (SW/NAC) Jerry Woller, USN)

137 Kodiak, AK (16 Dec 03) – PH2 Eric S. Logsdon, USN, observes SEAL (SEa, Air, Land) advanced cold weather training. (U.S. Navy photo by PH2 Eric S. Logsdon, USN)

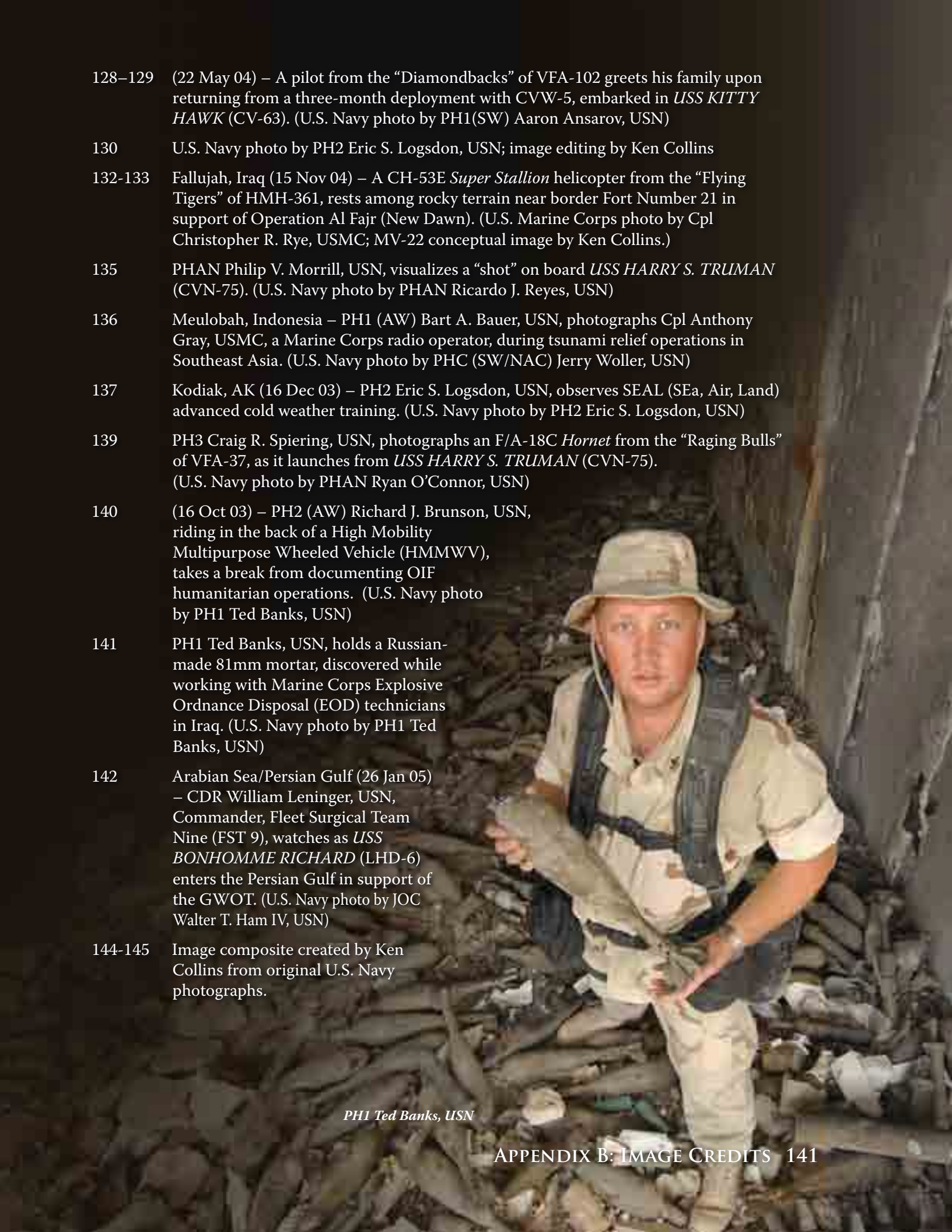
139 PH3 Craig R. Spiering, USN, photographs an F/A-18C *Hornet* from the "Raging Bulls" of VFA-37, as it launches from *USS HARRY S. TRUMAN* (CVN-75). (U.S. Navy photo by PHAN Ryan O'Connor, USN)

140 (16 Oct 03) – PH2 (AW) Richard J. Brunson, USN, riding in the back of a High Mobility Multipurpose Wheeled Vehicle (HMMWV), takes a break from documenting OIF humanitarian operations. (U.S. Navy photo by PH1 Ted Banks, USN)

141 PH1 Ted Banks, USN, holds a Russian-made 81mm mortar, discovered while working with Marine Corps Explosive Ordnance Disposal (EOD) technicians in Iraq. (U.S. Navy photo by PH1 Ted Banks, USN)

142 Arabian Sea/Persian Gulf (26 Jan 05) – CDR William Leninger, USN, Commander, Fleet Surgical Team Nine (FST 9), watches as *USS BONHOMME RICHARD* (LHD-6) enters the Persian Gulf in support of the GWOT. (U.S. Navy photo by JOC Walter T. Ham IV, USN)

144-145 Image composite created by Ken Collins from original U.S. Navy photographs.



PH1 Ted Banks, USN

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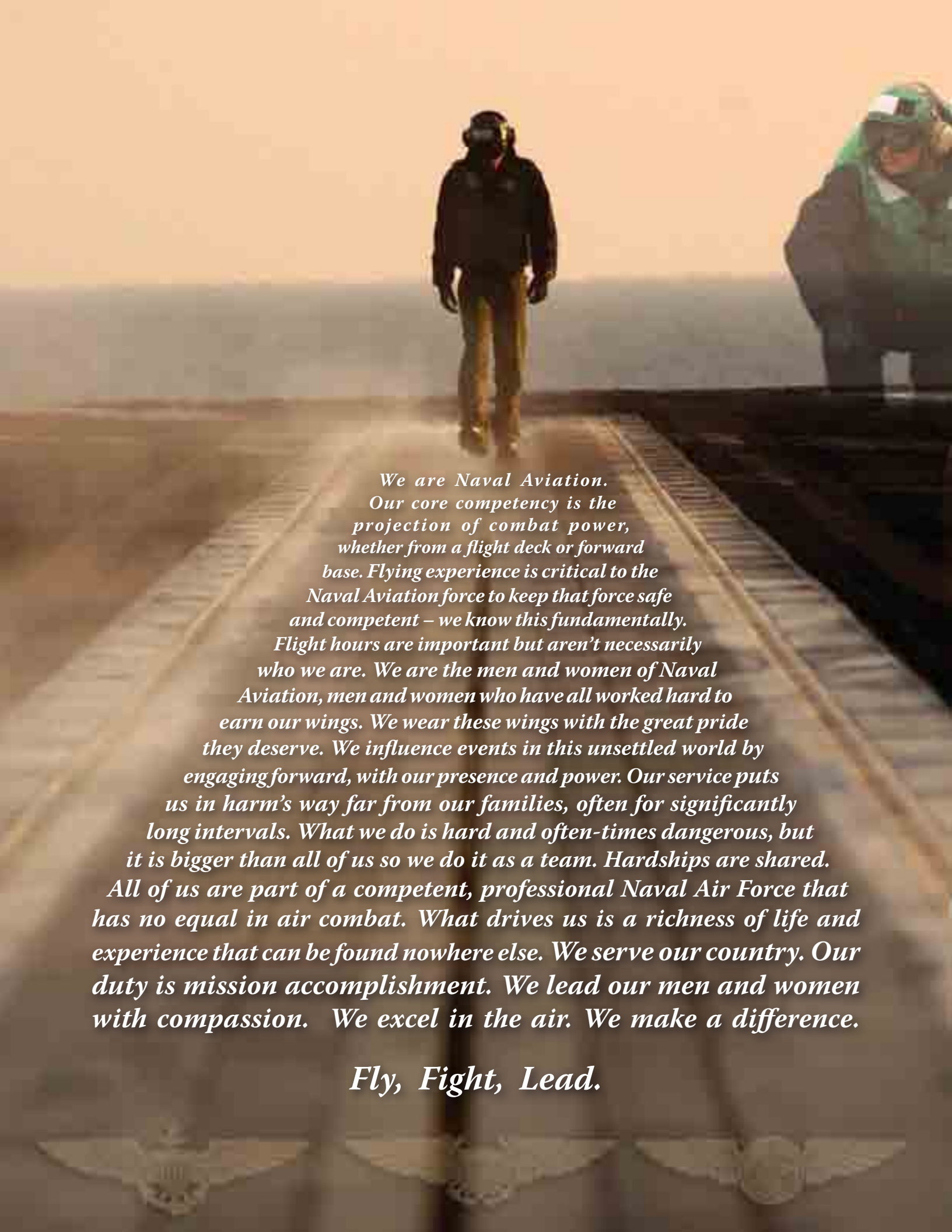
Acknowledgements

Many thanks to all of those thoughout the Naval Aviation Enterprise who contibuted to this document.

Special thanks to Omnitec Solutions, Inc. for their communications expertise.



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